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SINCLAIR'S SUPERMICRO

QL USER

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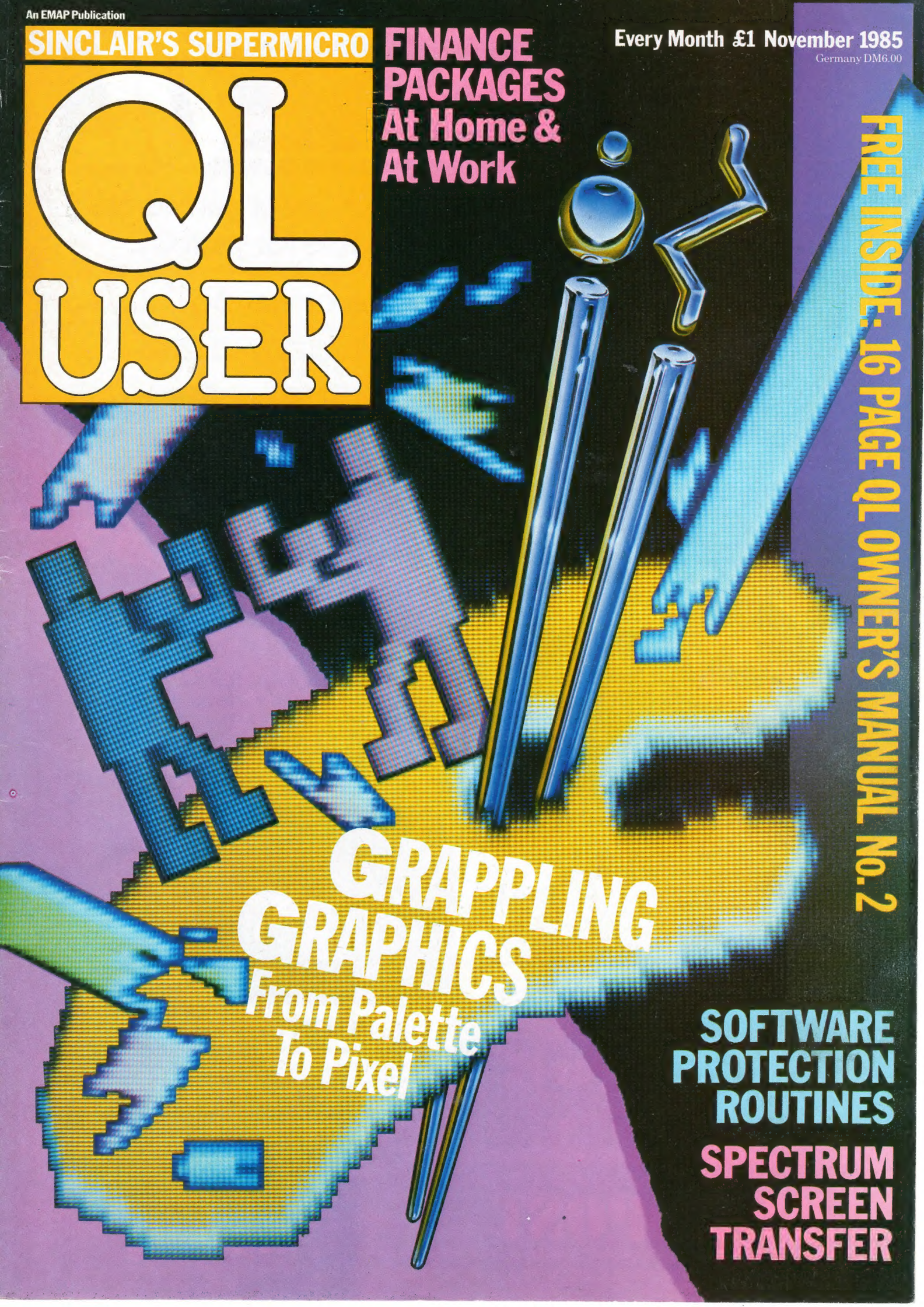

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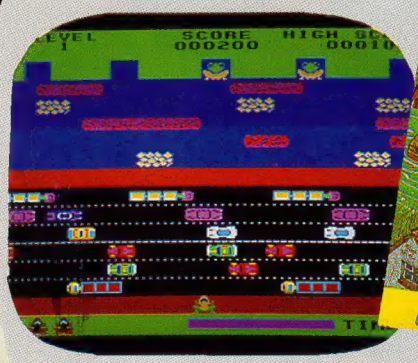

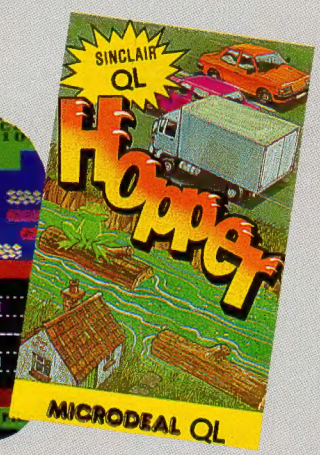

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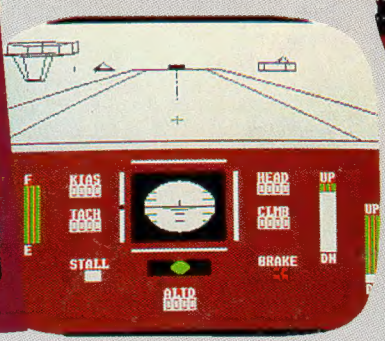

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QL USER

November 1985

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Technical Helpline

Owing to the large number of subscribers and registered readers who have been utilising this service, we have found it necessary to arrange for an external agency to handle all the queries.

For this reason the turnaround time from placing a call to receiving an answer will be seven working days (anyone who has experienced a longer delay than this may rest assured that the new system will improve matters – Post Office willing, of course!)

The number, for those who failed to obtain a copy of our September edition, is 01-250 0350 and the line is available from 5.30 in the evening to 9.30 in the morning (ie, outside working hours) and at weekends. Please remember, however, that the service is only open to QL User's subscribers (new and old) and those who receive the quarterly QL User Newsletter (readers who completed a registration card before the end of May 1985).

Transposition 85

Inexplicably, last month we managed to swap two listings and put them in the wrong places. To rectify matters just transpose Listing 2 on p.32 (Warm Reset) with Listing 2 on p.11 (ROMblings) – October edition.

CONTENTS

News 5

QLN

All the very latest news and events on the QL scene.

Cover Feature 8

Grappling Graphics

A survey of graphics packages vying for supremacy on the QL's screen.

Letters 12

Open Channel

Here's your chance to ask us some tricky questions (and get some tricky answers!)

Preview 13

Next Month

What to look out for in the fun-packed (!) December edition.

Feature 15

LOOK . . . Before you Quantum Leap

Beginners to computing and the QL look no further – here's where you begin . . .

Interlude 16

Puzzle Page

Held over from last month, some really challenging problems to solve on the QL.

Programs 20

'The Progs'

The first collection of readers programs for this month.

Cover Feature 23

Financial Report

Two accountancy packages – one for the home and the other for the office – reviewed side-by-side.

Series 24

Graphics On Display

The long-awaited final part of this absorbing series.

Cover Feature 26

Protect & Survive

No need to take cover, more a case of covering up your software against the prying eyes of the pirates.

Feature 31

Quidnunc

Writers may come and go but the basic brief remains the same . . . To expose myth, legend and rumour.

Readers' Service 31

Microdrive Exchange

Index of readers programs and order form for their duplication.

Books 34

Bookmarks

Another selection of books, this time not just confined to the QL.

Information 36

Instant Access

Our constantly updated chart of suppliers names and numbers.

Series 39

AI on the QL

Penultimate part of this sometimes esoteric exposé of the world of artificial intelligence.

Programs 44

'The Progs'

Our second selection, with the completed 'Pentathlete' from last month.

Cover Feature 48

Spectrum Connections II

Type-it-yourself listings and details for transferring your favourite Spectrum screens to the QL.

Reviews 50

Software File

All the latest QL software reviewed and assessed.

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London EC1R 3AU.

Telephone 01-251 6222

Published and Distributed by EMAP Business & Computer Publications.
Subscriptions, backnumbers and reprint information from: Carl Dunne (Magazine Services) on 01-251 6222 Ext 2429.
U.S. Sales Agent – Motorsport, RR1, Box 200D, Jonesburg, MO 63351.

Typesetting by Crawley Composition Ltd, Stephenson Way, Three Bridges, Crawley.

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FREE: OWNER'S MANUAL II
(pages 28–29)

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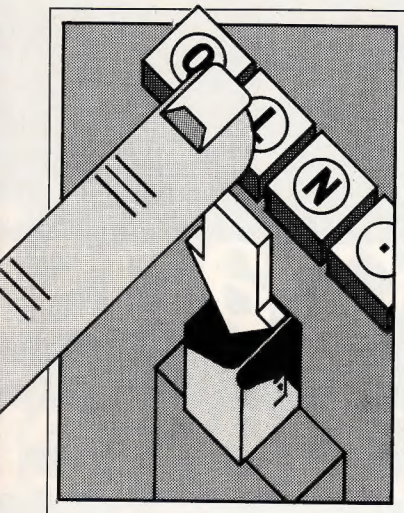


NEWS

The latest software, hardware and information on the QL product front.

Further Leaps?

Where do we go from here? This question seems foremost in the minds of Sinclair observers everywhere. A half-price QL leaves a vacuum at one end of the market whilst the Spectrum, despite the addition of a new keyboard, begins to look long in the tooth at the other end.

Indications are that Sinclair rather untypically will attempt to consolidate as opposed to innovate – improving on existing products rather than introducing new ones.

A 128K Spectrum Plus is a certainty. According to one source the machine "will be priced at £199" and will be launched in the period "leading up to Christmas". Sinclair, however, strongly deny this. According to them "no new machine will be launched until next year."

On the QL side, reports as yet unconfirmed lead us to expect a £350 version minus microdrives but with built-in 3.5" disk drive and colour monitor. There is also talk of improvements in the machine's communications capability and an increase in memory (RAM and ROM) which will allow a WIMPS system (Windows, Icons, Mice and PointerS) to be added to QDOS.

An upmarket QL as the flagship of the Sinclair range fits in nicely. It is aimed at the professional home user and small business – a potentially lucrative market which Sinclair was the first to recognise, has failed to capture but which it is not prepared to cede to the likes of Amstrad and Atari without a fight.

On the other hand, a big brother to the Spectrum, identical in price to an unadorned QL seems totally out of context. With two machines in the same slot Sinclair would seem to be competing with themselves. It will be interesting to see which one comes out on top. The deciding factor will probably be the software that is available for each machine. On this score the Spectrum has a clear lead but for how long? September's PCW show revealed a number of big software houses defecting to the 68000 machines, if this trend continues the QL becomes increasingly attractive.

The First Defector

Firebird Software, a big gun in the computer games market will shortly release it's first game for the QL. Called *Booty*, this is a 'platform' game set on a pirate ship where the player has to pick up, in sequence, a number of keys to open a treasure chest.

Firebird, a subsidiary of BT, is only a year old but already has an impressive string of chart-toppers to its name. These include *Gyron*, *Elite*, *Buggy Blast* and the *Demons of Topaz*, all of which make up its 'Gold Edition'.

Booty, however currently forms part of Firebird's 'Silver Edition' budget priced software and is the most popular game in that range. On the QL it will retail for £9.95. According to Firebird's Phillip Pratt the fourfold increase in price has to do with production costs associated with microdrives. However, to offset the added cost and make efficient use of available space on a cartridge Firebird have thrown in another game – *Grin Wars* – for free.

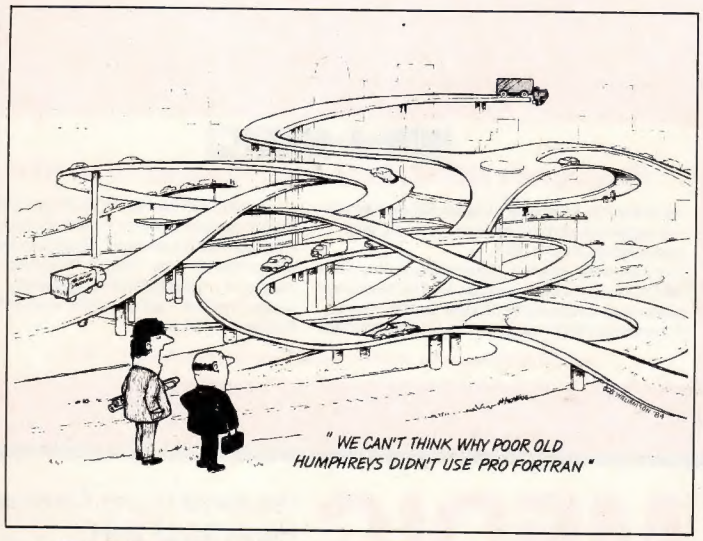
When asked "Why the QL?" Mr Pratt's reply was that Firebird "now recognised the existence of a new breed of games machines and that amongst these the QL with its established user base was a realistic proposition".

The release of Booty has been held back to coincide with other games coming for the Atari (and Amstrad) disk based systems.

Wrong Tack

Prospero Software will shortly be releasing the first FORTRAN-77 compiler and not C as was wrongly reported by us in 'Soft Landing'. Reverred by Scientists, beloved by engineers and avoided by all others, FORTRAN is the grandfather of most of computer languages and is still in widespread use today. Prospero hope that PRO-Fortran will open up the vast libraries of Fortran programs to low-cost 68000 machines such as the QL and that then "ideas like CAD/CAM workstations on every engineer's desk will become a reality".

The compiler, we understand, will produce position independent object code, have a speed optimisation option and make full use of the machines registers and instruction set. A run-time library will support I/O operations and handle floating point arithmetic. The product will be marketed by Sinclair Research though its pricing is, as yet, undecided.



Indemic Epidemic

It looks as though the idea of supplying internal upgrades to a memory hungry market is too good to miss! Following Silicon Express's lead, CST now offer to boost the QL's internal RAM up to a massive 512K. The operation will be completed over a 14 day period and will cost £172.50 including VAT. The extra £22.50 we understand will enable CST to extend their 90 day warranty to cover the QL's microdrives.

The drawback with internal RAM is that access times are shared with the QL's video processor as it refreshes the screen. This means BOTH products are slower than their externally fitted counterparts. However, with savings in the order of 50% only a perfectionist would complain! Perhaps more important, unless you are in the habit of writing ½ megabyte programs, is a RAM disk driver which allows one to use memory as if it was a disk or microdrive – only very much faster.

At present only Eidersoft with their GEM-like ICE package supply such a driver, though we suspect others will follow.

Noted Errata

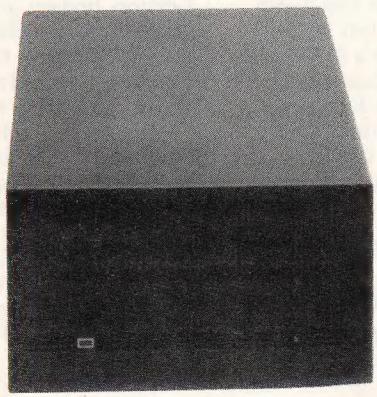
Thanks to John Chudley of Tiverton, Devon for spotting an erroneous line in the listing on p.11 of last month's magazine. It should have read:

260 IF rom_ver$(1 to 2) <> 'AH' AND rom_ver$(1 TO 2) <> 'JM' AND rom_ver$(1 TO 2) <> 'JS' AND rom_ver$(1 TO 3) <> 'JSU' AND rom_ver$(1 TO 2) <> 'MG' THEN PRINT "New ROM – contact me through QL User": STOP

And, if you haven't already noted it, that listing should be transposed with the one on p.32 as outlined on the contents page.

MEDIC
-leaders in QL expansi
-introduce Winchester

The MEDIC Winchester hard disk

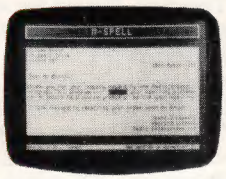


Free Business Software

Nine performance-raising programs, free with every MEDIC disk drive system.
(Extra memory recommended.)

M-DESK

M-TRANSFER



M-SPELL

M-MERGE

M-DESK Macintosh-type single-key depression user interface, for instant program switching and utilities selection **M-BASE** turns Archive into a menu-driven database with single-key commands **M-ACCOUNTS** fully integrated sales, purchase, nominal ledgers, and stock control **M-KEY** single-key entry of user-defined text in any program **M-SPELL** spelling checker **M-MERGE** personalised mailshots **M-SQUEEZE** file compression **M-BOOT** sets up RAM disks in memory then automatically loads pre-defined files and programs **M-TRANSFER** microdrive – disk routine.

MEDIC – leaders in disk drives and expansion systems for the Sinclair QL – now introduce a Winchester hard disk which gives a full 5 MB of formatted text/data storage, enabling the QL to be used in major business applications.

At only £299.95, including interface, the new MEDIC Winchester is amazing value, turning the QL into a full-scale business machine. The MEDIC Winchester offers a very fast transfer rate (256 kilobytes/second) and stores valuable data more safely than either floppy disks or microdrives.

The new MEDIC Winchester ensures easy data location and access through its sub-directory capability (can be configured to emulate a series of floppy disks).

THE MEDIC EXPANSION SYSTEM

"Medic have set out to manufacture the definitive expansion system and have to a large extent succeeded." (QL User, August 1985).

Fit a Medic expansion system – via the unique plug-in systemcartridge – to your Sinclair QL, and you immediately transform it into a fast, powerful business machine.

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All Sinclair QL owners are eligible for this free draw – complete the entry on the coupon now, and post before October 30th.
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Numeric keypad Needs interface, see below £29.95 ☐

Mouse Includes M-Paint graphics program, needs interface, see below £49.95 ☐

Interface For numeric keypad and mouse (only one needed to connect both items via ROM port) £14.95 ☐

Printer Cable QL parallel printer cable £14.95 ☐

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*you do not need to order items to participate. But all name and address details must be completed (No signature necessary).

Please send me the items I have ticked on this order form and I agree to pay cash on delivery. I am over 18.

Total order value (inc p&p) ☐

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All sections must be completed, PLEASE USE BLOCK CAPITALS.

GRAPPLING GRAPHICS

William Owen sums up the State of the Art on the QL.

Anyone who has used a painting system on a computer will know of the immediate sense of power, skill, and – possibly – delusion of artistic prowess it gives. The software provides the technique, not the talent.

But painting by computer is hardly painting by numbers. The sudden and surprising ability to draw a perfect circle simply releases the imagination – painting by numbers locks it up. The finest graphics generators have up to a million colours and dozens of textures and brush strokes, and some enable the construction of 3D solid models, in colour, with shadowing calculated from any light direction and density. The latter requires a lot of memory and a lot of processing time, but you don't need a mainframe or mini to generate complex, static graphic forms: a QL will suffice.

Any object – or idea – that requires two or three dimensional representation can be modelled by a computer with greater speed, accuracy and realism than traditional methods – pen on paper, ink on canvas. Computer graphics packages, and there are more than one type, provide the artist with a flexible drawing or painting tool and the designer with drawing board, pen, rule, scale, compass and eraser.

The most advanced computer aided design (CAD) systems will also include the ability to construct three dimensional models from a 2D plan and elevation; automatic dimensioning of each part of the plan from scale; libraries of standard components which can be withdrawn and placed at will on the design: and sometimes knowledge based systems which will, for example, determine the correct value of components for a given electronic circuit, or calculate whether a prestressed concrete bridge can stand the load to be imposed upon it in real life.

Exactly what the state of the art is in mass market graphics packages is hard to fathom. The reason for this is that the newest micros have some, but not all, of the power of last year's mini's. However, animated images (moving pictures as opposed to simple sprites) and three dimensional modelling seem to be the most likely developments. Neither are likely to appear on the QL.

As regards animation the 68008 simply cannot cope. It would require a dedicated custom chip like on the Amiga to take the pressure off the main processor and speed up drawing. Here animation is accomplished through a simple set of subroutine calls that draw a linked list of items in quick succession across the screen: for example making a sphere rotate and move along its axis.

Similarly, without the virtually inexhaustible amount of memory afforded by hard disks 3D modelling is not a practical proposition. Even simple wire frame drawing techniques, with or without hidden line removal, are voracious consumers of memory. Indeed, to find a competent software package that will give a 3D drawing based on a plan and elevation you will need to go to the very top of the desk top PC range with costs escalating into five figures.

So what should you expect from first class, micro-based, two dimensional design or painting software?

QL graphics packages should be measured against the best available for low-cost 16-bit and 8-bit micros. The QL is after all a high resolution computer with a capable processor. Good benchmarks are, for graphics, GEM Paint, and for CAD, Robocom's Bitstik 2. These packages include all of the essential features and introduce most of the new concepts in electronic design and drawing.

GEM Paint, available from Digital Research on the IBM PC, Apricot and Atari 520ST, is the kind of software for which you only need to reach for the manual when contemplating advanced operations. It's almost entirely icon-based; that is, all the commands, colours, textures etc are captured by the click of a mouse. Ease of use is not an essen-

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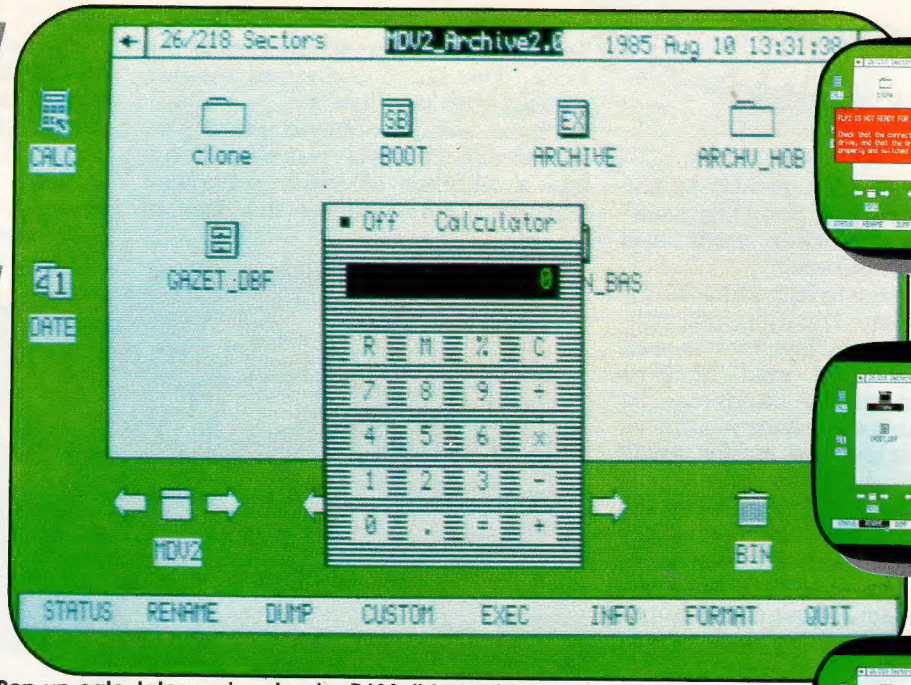
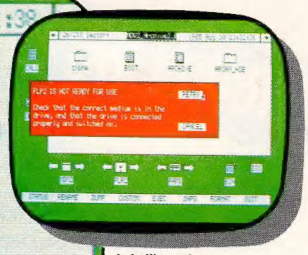
ENVIRONMENT

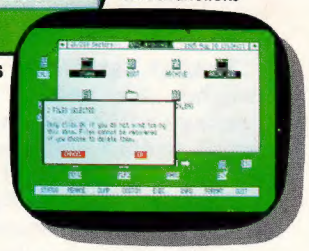


Pop up calculator and calendar RAM disks and full range of QDOS functions

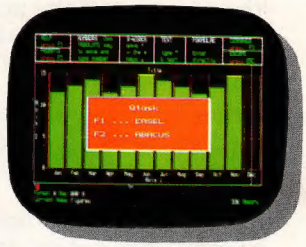


Intelligent error messages

Multitasking clock full range of QDOS functions



Folders allow action on multiple files



Multi-task a number of programs (memory permitting) using CHOice tasking software with mailmerge

ICE is a Fully Icon Based Desktop Manager and Front End for QDOS

ICE makes all of the day to day tedious computer housekeeping (eg. deleting and copying files) you need to do simplicity itself. By using pictures (Icons) to represent the functions you want and the files on your disk or microdrive, all you have to do is point and click, instead of typing reams of mysterious commands. ICE is extremely powerful and can take action on many files at the same time, saving you hours each week! ICE gives you an inbuilt multitasking clock, calendar and calculator for up to the minute efficiency.

ICE also includes the powerful CHOice tasking software that allows you to run several programs simultaneously!

ICE comes on EPROM cartridge that plugs into the cartridge ROM port at the rear of the QL.

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☐ tick if you require disk drive system information

☐ tick if you require ARCHIVER information

I enclose a cheque/PO/card no. for £.....

QL11

tial feature but adds greatly to the pleasure of using a painting package; it allows quicker work and endless experimentation.

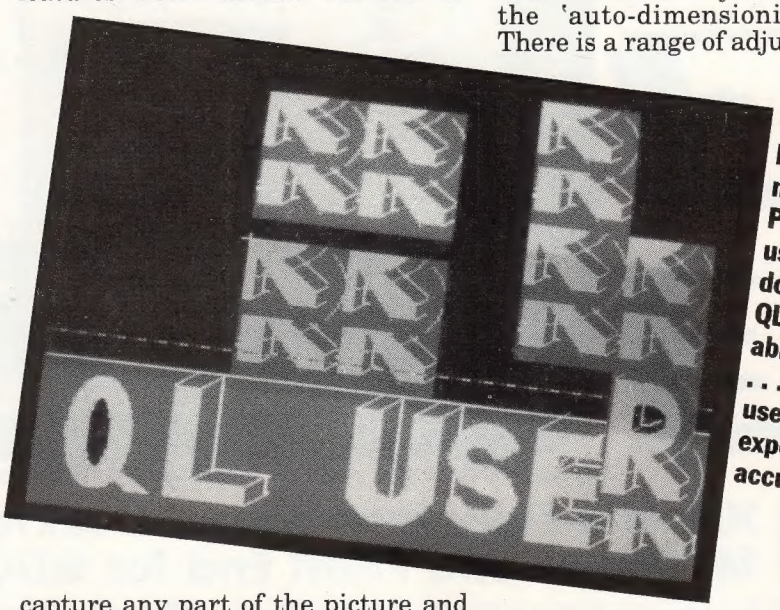
Now is the time to introduce a new concept to artists: the dynamic, rubber banded cursor. The tool is well named. Imagine a grid of pins around which rubber bands can be stretched. The user selects a point on the screen, takes the cursor away from it in any direction, and a line, dynamic because it moves with the cursor, appears between the cursor and the original point. Rubber banding is a fast and easy way to create both regular and irregular shapes which can then be filled with colour, texture, or both.

Rubber bands are new to artists, brushes are not. A good painting package will have a wide selection of brush widths and textures, possibly an 'air brush', and it will have automatic 'fill' – filling an area within a closed boundary with colour. There is also the 'pencil' which draws in a freeform fashion under the direction of the mouse.

Brushes should be able to draw in any texture, colour, or mix of the two. In Gem Draw the user can define any brush size and shape as well as using those available on the screen menu, which allows quite a variety.

There are two more basic tools. Firstly, geometric shapes: a selection of circles, squares, rectangles, and other polygons is available for the user to insert onto the drawing at any position, in any size. The second is the eraser. You should expect two kinds of eraser: a simple mouse driven rubber that moves around the screen erasing unwanted areas; and more importantly, a facility that undoes the previous command. For example, if the user attempts to fill an area with an incomplete boundary, the colour can 'leak' out and destroy the rest of the work. The Undo command insures against such a calamity.

Those are the basic tools you should expect to see, but Gem Draw has a number of other advanced features. Zoom enables the user to capture any part of the picture and magnify it to the full size of the screen in order to carry out detailed work. Areas of the screen can be moved to different positions, or copied any number of times. Finally, a drawing or section of a drawing can be distorted, ie, stretched or squashed.



"MPaint from Medic comes nearest to Gem Paint for ease of use, though it doesn't utilise the QL's graphics ability properly . . . It's a joy to use, but don't expect to do any accurate work."

Painting packages require flexibility, speed, colour and texture, whereas in a drawing package the emphasis should be upon accuracy and attention to detail.

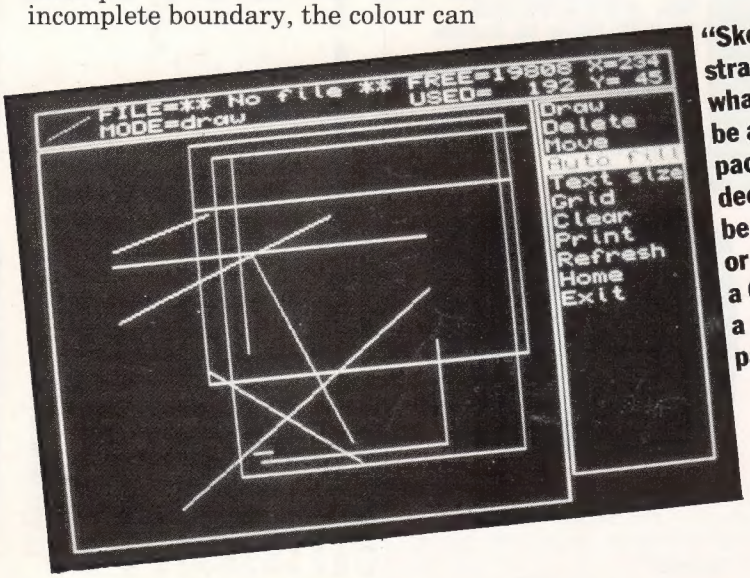
Bitstik is probably the only micro-based CAD package that offers all of the facilities expected by a professional. Like Gem Draw it is icon based and mouse, or rather joystick driven. As well as a dynamic rubber banded cursor (a feature which is more important in a drawing package anyway), fill, colour, etc, it has a number of more impressive features. Zoom allows the user to magnify a section of an image an infinite number of times to obtain incredibly precise detail. Each drawing can be given a grid around which the cursor jumps in steps to ensure geometric accuracy. Measurements are generated automatically from a scale by the 'auto-dimensioning' facility. There is a range of adjustable curves available to replicate the traditional draughtsman's tool. Angles can be locked into place at a given degree. Finally, there is an extensive library of graphic forms which can be added to by the user – what you might call electronic Letraset.

So can the QL offer anything like these two packages? The short answer is no. Most of the software available for the QL doesn't do the machine justice, although a couple of packages come close.

MPaint, by Medic Datasystems is the painting package that comes nearest to Gem Paint for ease of use, though it doesn't utilise the QL's graphics ability properly. There are only four colours available: black, white, red and green; these colours can be stippled (there are 126 stiples) and mixed, and there is a useful and effective facility to change the colour mix of the entire screen.

MPaint is icon based with eight pull-down menus as well as the brush, colour and texture menus at the side and bottom of the screen. The menus include print (with Epson FX80 screen dump); store cursor (to choose the type of cursor required); shade; stiples; help (limited); and shapes. Shapes, which can be filled, include circle, triangle, square and pentagon, the sizes of which are defined by the user. There is no facility to fill shapes drawn with the brushes or pencil.

There are six standard brush sizes, and a range of unusual brush forms made up of rows of dots, giving the effect of three to five pens used together. These brushes force the user into an interesting style



"Sketchpad is a strange name for what purports to be a CAD package. It can't decide whether to be user friendly or multi-featured, a CAD package or a painting package."

reminiscent of 60's wire and colourfield paintings.

A standard blackboard eraser is available, and the essential 'undo last command'. But there is no elastic banding, no zoom, and no grid. MPaint is a joy to use but don't expect to do any accurate work.

Talent's Graphiql, now sold under the Sinclair label as QL Paint, is a world away from MPaint. It's a devil to use, but then the artist must suffer for his genius. Graphiql has every facility imaginable, but all are accessed via command codes rather than icons. Inexperienced users will have a manual by their side for the first few weeks.

Graphiql uses eight colours which, in the XOR mode can be mixed (laid over one another) and textures which the user can define pixel by pixel. The QL's flash feature is also available. There is a complex set of erase commands, including the ability to remove overlaid colour, and delete sections of lines. Circles, elipses, squares and rectangles can be drawn by the rubber banding cursor. There is an airbrush, but no other standard brushes: lines are drawn by plotting from point to point. Irregular and rectangular areas can be defined and filled with colour or texture. Sections of the drawing can be copied, reflected on the horizontal or vertical plane, rotated or moved.

It is difficult to do justice to the many and varied commands of Graphiql in so short a space. Suffice to say that with Graphiql anything is possible, but not necessarily easily achieved, and to add to that, drawings can be included within SuperBasic programs, and that Talent intend to add an animation facility in a future version, to be used for designing animated sequences such as explosions, or moving characters.

That leaves Paintmaster – an inferior package – Sketchpad, and QLCAD. QLCAD is not quite what it sounds. It is not a straightforward computer aided design package: it is an electronic circuit designer. QLCAD is easy to use software, no frills but all the essential prerequisites. Circuits are drawn on a grid using a library of 66 component symbols: capacitors, diodes, transistors, ICs, op amps, speakers, microphones, earths, etc. Any not included in list can be defined by the user from SuperBasic – a full listing of the software is included in the manual. Four colours are available.

Sketchpad is a cross betwen Graphiql and MPaint, in that there is a limited degree of help from icons and quite extensive drawing, rather than painting facilities. It is sold primarily as a CAD package but comes nowhere near the professionalism of Bitstik. Applications suggested in the manual include circuit diagrams, layout design, engineering drawings and games screens.

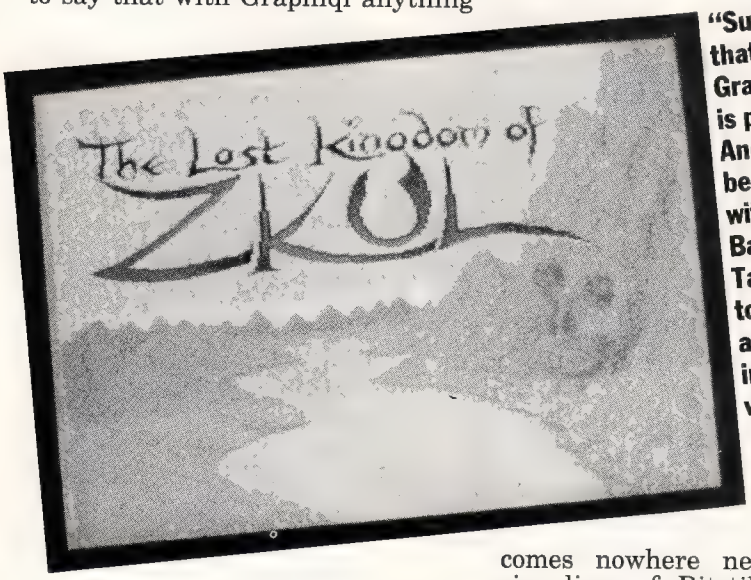
A grid is available, the size of which can be defined by the user, which promotes a degree of accuracy. Window sizes and shapes can be defined. Points at either end of a line are plotted out by the cursor without a visible elastic line. The system can draw circles, triangles, rectangles, ellipses and arcs of user-defined size. There are eight text sizes in four colour mode, and four in eight colour mode. Defined objects can be moved and deleted, areas filled with colour and stiples. There are no brushes, only a 'pencil' facility 'which should be used sparingly because it uses a large amount of memory'. Screens can be dumped to Epson compatible printers.

Sketchpad is a strange name for what purports to be a CAD package. The system is caught between four stools. It can't decide whether to be user friendly or multi-featured, a CAD package or a painting package.

Paint Master, finally, will allow you to master very little. It is a wax crayon to Graphiql's box of oils. Two unimaginative demonstration screens give an accurate impression of Paint Master's limitations. For some reason it uses only four colours in eight colour mode. It will draw a circle, an arc, a rectangle, a line, and a 'box'. It has a grid, a stipple generator, an eraser. All that could easily be achieved on a Spectrum, where Paint Master would feel much more at home.

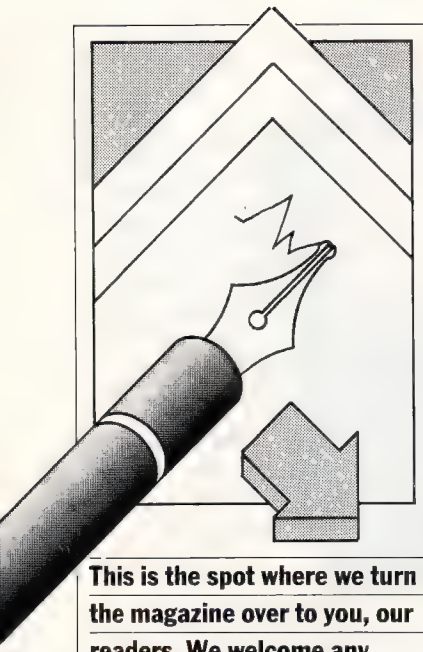
There is one exceptionally good painting system for the QL – Graphiql – with as many features as GemDraw (and more) and one – MPaint which is as much fun to use. Any software house which could combine the best qualities of the two would be on to a winner. Yet unfortunately the QL is still without a genuine multi-purpose CAD package. When one does come along, as of course it will, could the software house responsible please include the routines to print drawings out on a high resolution plotter? When Robocom first launched the Bitstik on the BBC micro this was one rather essential item it forgot: and all artists and designers should remember that, to do justice to their work, a colour printer or plotter, or at the very least a camera, is the peripheral of the hour.

"For some reason Paint Master uses only four colours in eight colour mode. It will draw a circle, an arc, a rectangle, a line and a 'box' . . . All that could easily be achieved on a Spectrum."



"Suffice to say that with Graphiql anything is possible . . . And drawings can be included within Super-Basic programs. Talent also intend to add an animation facility in a future version."

OPEN CHANNEL



This is the spot where we turn the magazine over to you, our readers. We welcome any comments, criticisms or anecdotes about either the QL or QL User. The address to send your letters is: Open Channel, QL User, Priory Court, 30-32 Farringdon Lane, London EC1R 3AU

DEMOnic Disruption

I expect that everyone has noticed the QL demo program running on most display models. However, whilst trying to stop the program to get a better look at the screen picture from 'Caverns' I discovered something quite amusing. Try pressing <CTRL+ALT+7> and the expected WON'T happen. Incidentally, you can freeze the program by pressing <CTRL+F5>.
Richard Gray
Rugby

Post Haste

After reading your review of QL Cavern I waited patiently for it to arrive in W H Smiths. After two months I had had enough and I decided to mail order a copy from one of your advertisers instead and received it promptly a week later.

At first 'QL Cavern' was a challenge and a welcome relief from programming. But then I discovered a few annoying anomalies. On screen 10 if you try to cross over into screen 11 from the bottom right-hand corner – flying too low will result in the loss of all your hard-earned lives. The same happens on screen 46 – crawl on to the 2nd detonator located far right.

However, whilst I am prepared to forgive these niggles QL cavern does have one major flaw. It's far too easy!
R Hartell
Pontypridd

Same Old Story

Having been bitten once by the "28 delivery" come-on – when I ordered my QL in February last year – you might think I would be twice shy. But no! I've been hooked once more, this time it's Medic Datasystems, whose QL expansion system ordered June 27 on the strength of advertised guarantees of delivery within 28 days, and even immediately from stock, has not yet arrived (September 3rd).

Telephone calls to remonstrate have been met with the excuse that supplies of boards to Medic itself were late – until last week, when I was told it had been dispatched. Today, still without a system, I phoned to be told that they were too busy preparing for the PCW show to meet orders!

When I suggested that this excuse was inadequate, the woman at the other end sounded quite put out. There was nothing she could do about it and I would ("jolly well" she didn't quite say) have to wait until next week or have my money returned. I feebly opted to wait yet again. I wouldn't have earned any interest on the cash, anyway: I'm paying it – it's a bank loan.
Simon Reynolds
Earlsfield

Whether by phone or by letter the message about Medic is clear. Quite simply, they are giving the entire QL market, which is predominantly mail order, a bad name. Whilst their hardware works and works well, it takes ages to arrive and has only recently been properly boxed.

Furthermore, aside from M-PAINT (the only package so far submitted for review), most of their advertised software appears to be unfinished. For example, copies of M-Cosmic, M-Treasure, M-Cruncher and M-Metropolis sent in by disgruntled readers failed to load at all. As for nine free packages with their hardware, if anybody has seen them working – please let us know!

It is a crying shame that a company with so many good ideas for the QL seems incapable of getting its act together. Yet perhaps the worst thing about a situation like this is that the sins of one supplier are often visited upon the rest. This is quite unfair. So in an effort to redress the balance QL User welcomes any telephone enquiries from readers prior to purchase, to ascertain whether any complaints have been made about a company.

QL Lock Up

David Hawley's letter (August) could easily have been written by myself; I overcame many of the microdrive problems by following previous advice in QL User to use a mains filter, but an apparent 'overheating' problem causes lock-ups, and I too cannot afford to be without my QL for an extended period.

I have written to Sinclair Research suggesting that the company should provide some QLs to selected dealers as part of an 'exchange maintenance' scheme for existing users. I for one would be prepared to pay a reasonable price for the loan of a machine while my own was being repaired. Is there likely to be adequate support amongst readers for such a scheme?
David J Howard
Herne Bay, Kent

In our experience the QLs only freeze when there's a tight deadline and keys are being hammered for all they are worth.

As for overheating, however, we've found no such problems (yet!). Consequently, it may be an idea to look elsewhere for your fault. Aside from power spikes, a common source of lock-ups is a 'leaky' cable – monitor or printer type. Borrow a friend's and see if things improve.

Even with the low price, the exchange scheme seems a good idea. Certainly, in the (very unlikely) event that all five QLs used to run this magazine broke down it would be a disaster if no replacements could be found.

Something Old . . .

A few weeks ago I bought a new QL, which I have been satisfied with. However, I was disappointed to find that this has QDOS 1.02, whereas a friend's, which was bought a year ago, has QDOS 1.03. Clearly mine is an old machine, and I wonder if I have a valid cause for complaint. There seems nothing wrong with it, but I bought an early Spectrum, on which only after some use did I discover software bugs.
G Rutter
Maida Vale

As many people will be contemplating buying QLs over the Christmas period it seems like a good idea to set the record straight.

When buying a QL you should check that you have version 'JM' or, even better, 'JS' of the ROM or versions 2.00 or more (ie 2.03) of Psion's packages. To find out about the ROM simply type PRINT VER$. As regards Psion's packages, load each in turn and check the opening screen.

Pen Pal

Since QLs have only been available in the USA for less than a month I am a very new QL User. I read with great interest the June, July and August issues of QL User which I obtained from Curry Computer. After reading these magazines I was struck with some thoughts which may be of interest to peripherals manufacturers.

Unfortunately it looks like we are in for the great 'hang-it-off-the-side' parade just as we have seen on other computers which do not have internal expansion slots. Please, please someone use some ingenuity and save us from a desk that looks like a spaghetti junction.

Also why all the disk drives? How about a mouse, light pen and internally fitted expansion?

Finally, in closing let me say that I was impressed by your objectivity which is unusual for a dedicated-product magazine.

Lance Presnall
California

All Clear

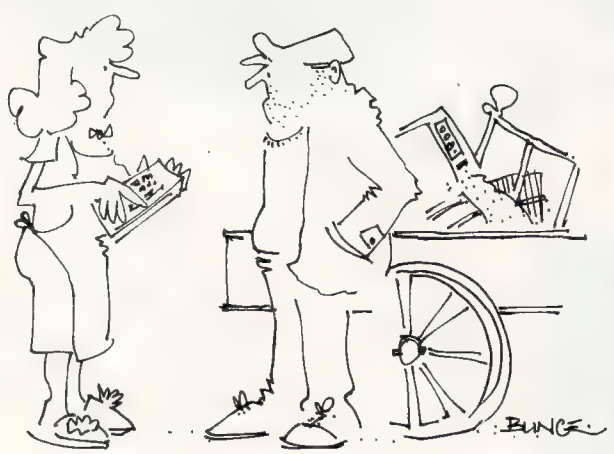
I was happy to find the article "Dipping In" in the September issue as I am one of the many who use an EP44 as a printer with his QL. I also use the Sinclair RS232 lead that was supplied by the Brussels dealer from whom I purchased both pieces of equipment. The interface has worked without any problems for some five months. Now, having read that the Sinclair lead needs modifying in order to avoid disastrous consequences. I am concerned that I may be damaging either or both pieces of equipment by using what, so far as I am aware, is an unmodified lead.

My QL is version JM with a QWERTY keyboard. The EP44 has an AZERTY keyboard. Thanks to editing the driver lines as recommended I can now print underlining. I still cannot get the "pound" sign to print. My EP44 has such a sign; the QL keyboard does not. I therefore cannot edit the TRANSLATE1 code in my Psion driver.

R M Henderson
Andorra

We can only assume that in selling both items of equipment your Brussels dealer has supplied you with a dedicated lead and not the RS232 cable early users received free with their QLs. If the cable has worked for five months then we can see no reason why it should not continue to do so.

It seems remarkable that you have a version JM QL and yet no <£> sign unless it is one of the foreign adapted machines. Anyway you can reprogram any key to produce the sign simply by entering its code followed by an EP44 code which for <£> is 156. For example, enter TRANSLATE2 127,156 and every time you press the copyright <©> symbol a pound sign will print. If you look under "Character Set" in Concepts section of your manual you will find all the QL codes you require.



A PET 2001? I'll give you two cleaning stones or a goldfish.

NEXT MONTH

GAMES GALORE

They said it couldn't be done, those sceptics of the QL and all it's achieved, but we knew better and next month sees the fruits of several weeks slaving over a hot joystick.
If you've held back from buying a QL for lack of entertainment value, or just want to know more about the diversity of games available, then DON'T MISS IT!

Buyer's Guide

A guide to buying what? Not different QL models as there is only one (at the moment!). No, this is a guide to all the hardware that has been, or is soon to be, released for the QL – you name it, we've included it.

Spectrum Connections III

The third in our series on Spectrum/QL communications and a boon to all database users.
We outline the necessary leads, connections and software to copy a Spectrum database to the QL's Archive.

Progs Special

We've been saving some really amazing readers programs in order to present a special Christmas selection. So, you'll have plenty to get your teeth into once the more usual gastronomic delights associated with the festive season begin to lose their appeal.

PLUS

The final section of our exclusive, three volume QL Owner's Manual.

ALL INSIDE THE

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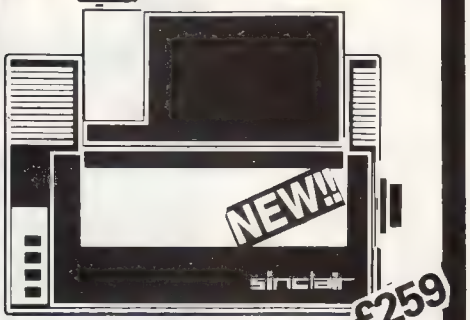

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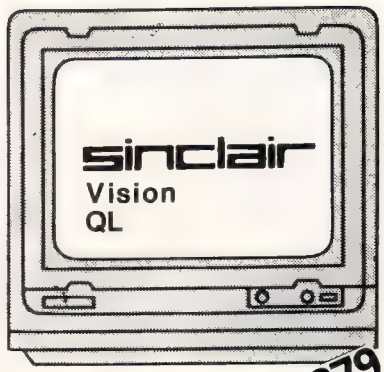

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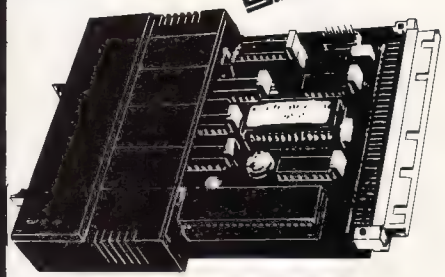

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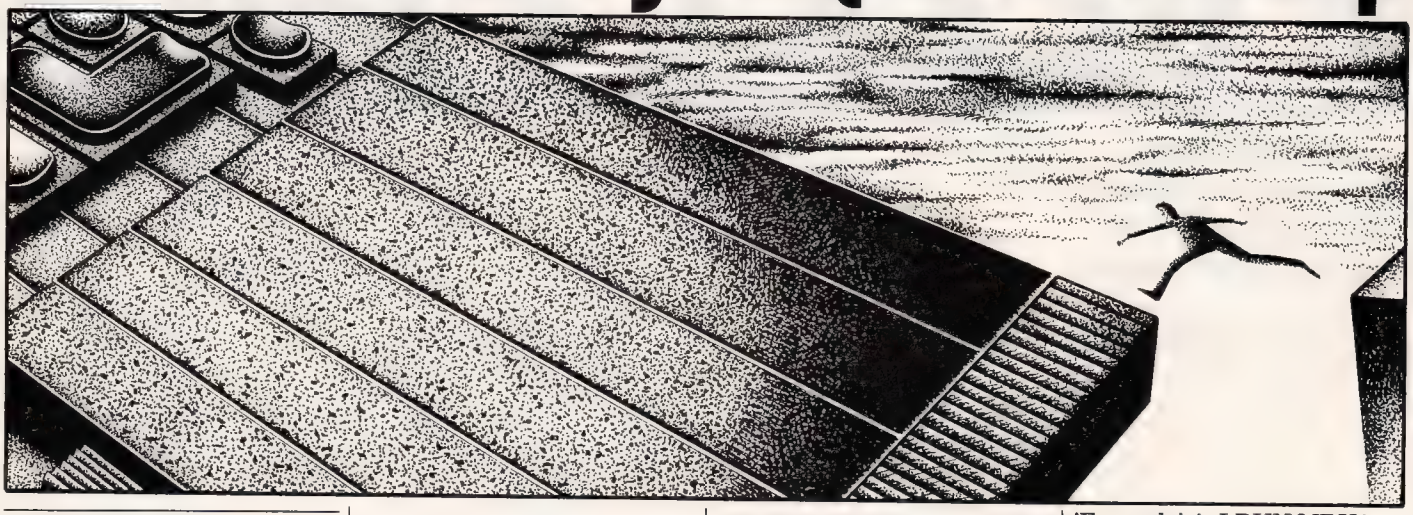


ILLUSTRATION BY ROY INGRAM

A mildly irreverent introduction to the QL, written especially for the newcomer to computing, by Christopher Sherwood.

Let's assume that you have either just bought a brand new QL and bundled software, or are contemplating same in the near future. For those completely new to computing, opening up the QL package is a daunting affair – the manual resembles 'War and Peace', there seems to be an inordinate number of wires for such a slimline machine and there's a sinister looking black box hiding in one corner.

Contrary to what might be expected, the beginner's next step should definitely not be to open up the manual. This hefty tome is best left well away from the QL – for the first week at least – save it should lead to premature ageing and other stress-related disorders. Yes, the manual supplied with the QL is one of those most hated of literary works – Ode to the Technical Author – and beginners are well advised to steer clear of it for as long as possible.

First Steps

The first step then, after unpacking everything, is to put the cable terminated with small jack plugs back into the box – it's not needed now and is probably best forgotten. Next, plug in two of the four plastic feet on the underside of the QL (towards the back) – the other two are a waste of time and should also go back into the box.

The one thing missing from monitor, so in keeping with machines like the Commodore 64 and Spectrum a standard TV set is required. Here's where the aerial lead supplied comes in – one end plugged into the QL's UHF socket and the other into the aerial socket on the TV (it won't do any harm for owners of monitors to check out their QL on the TV first).

Now plug the power supply (that black box) into the mains, but not the computer yet – some of these rather temperamental beasts seek their vocation as trainee worker bees (they buzz). If the power supply you've got is one of these (and we're talking about a fairly loud grating buzz), then it should be replaced now.

Assuming everything to be OK, plug the power supply lead into the QL socket marked Power, press the square reset button on the side of the machine and switch on the TV set. Tune the television until the QL's set-up screen is shown (it's a green box on top of a wider red one) and then press the F2 button on the QL's keyboard. The machine is now ready.

Checking the operation of the QL and power supply is relatively simple – the power supply will produce a faint hum when working properly and the QL's yellow LED will light in the bottom left hand corner of the console. Immediately after pressing F2, the left hand microdrive should whirr and its red LED light briefly. If all this happens and there's still no picture then its the TV at fault – try retuning in the channel, which is usually close to that used for video recorders.

At Your Command

When the QL is booted up (ie, F2 is pressed – when a TV is being used), the screen shows a large red rectangle and a flashing cursor below it. The rectangle is a display area called a window and is one of three such areas produced after booting up the machine. An identical area behind the red rectangle and the area in which the cursor moves, are the other two windows.

Information (eg, printed text) is displayed in one of those three areas, designated #0 (cursor area), #1 (red) and #2 (blue area behind the red). Anything typed into the machine will appear on #0 and anything output from the machine on #1 or #2. All the non-programmer needs to know is that some commands can access different screens (eg, CLS #1 means clear screen number one and CLS #2 means clear screen number two). The screen dimensions can also be changed so that it is possible, for instance, to display several screens with different information next to each other. This is very simplified, but will do for now.

If programming definitely isn't one of your reasons for choosing the QL, there are not many commands that need to be known. Accessing the microdrives, loading and running programs can all be accomplished with the use of LRUN (ie, Load and RUN).

The QL recognises the microdrives as MDV1_ on the left and MDV2_ on the right (don't forget the underscore, it's important). The complete command, then, for loading and running a program on microdrive one called 'Example', is LRUN MDV1_EXAMPLE. The four Psion programs supplied with the QL can be loaded and run in a similar fashion, though it's a good idea to make a copy of each of them first. Unfortunately, this will make use of four clean microdrive cartridges, so it's a case of deciding whether to make back-up copies and buy some more microdrives, or burn your bridges and use the original programs.

Whatever you decide, before using any blank microdrives they must be 'formatted' with the aptly named command FORMAT. Formatting is basically a means of arranging the tape on the microdrive into blocks of equal size to take fixed quantities of information in a controlled way. It also allows you to name the drive (eg, FORMAT MDV_TEST will format a microdrive cartridge inside the left hand microdrive slot and give it the name 'Test').

It's surprising the number of different paths that the owner of a new QL can follow after grasping a few fundamentals of using the machine. We've covered setting up the machine in its most simplest form (QL, power supply, TV set), formatting microdrive cartridges and running programs. Believe it or not, that's all newcomers to the machine need to be familiar with before advancing into their own areas of interest. That's where *QL User* comes in. In the middle of this month's 16-page Owner's Manual (between pages 28 and 29), there's a tree diagram called 'Where to go from here'. This sets out a wide variety of possible options for the QL owner and, more importantly, where *QL User* has provided some editorial coverage on those subjects.

PUZZLE PAGE

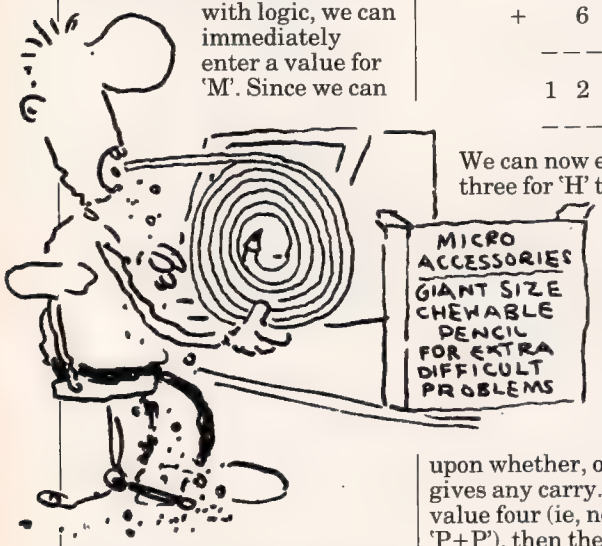
Technical author Marcus Jeffery presents some of his favourite mind-bogglers and other assorted old chestnuts.

Has anybody ever said that two chips make a micro. No? Well, I can prove it . . .

```
  C H I P
+ C H I P
---------
M I C R O
---------
```

This familiar form of substitution problem can be quite fun to invent, and in this case is very easy to solve.

Before getting bogged down with logic, we can immediately enter a value for 'M'. Since we can only substitute a single digit for each letter, the maximum value of 'C' must be nine. Adding the two 'C's (even assuming a carry from H+H) still only gives a total of 19, proving that the value of 'M' must be one.



We'll now try to substitute minimum numbers to find a solution. To obtain the carry (for 'M'), we know that 'C' must be greater than, or equal to, five. If we try this to begin with, we will get the result ten or eleven, depending upon whether the previous addition (H+H) gives a carry digit. Unfortunately, the answer eleven is no good, because this contains the same digit twice (ie, '1') in the positions occupied by 'M' and 'I'. So, let's assume that 'H+H' does not give any carry. Thus, 'C+C' results in ten, making the value of 'I' equal to zero:

```
  5 H O P
+ 5 H O P
---------
1 O 5 R O
---------
```

As you can see, O+O will give no carry, yet (due to the C=5 in the result) 'H+H' must return an odd number – impossible, so we'll have to backtrack and try another number for 'C'.

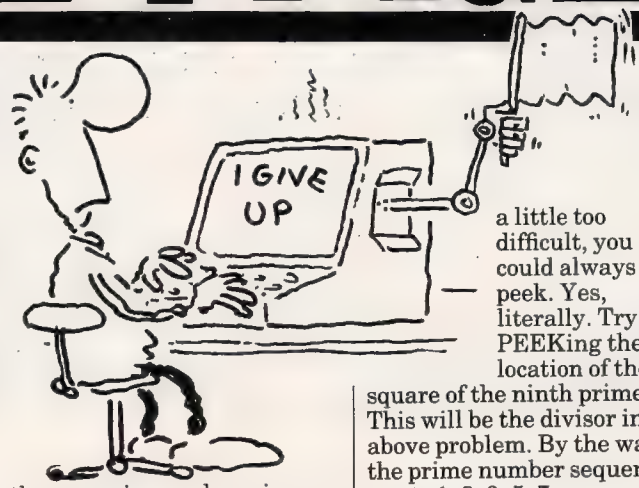
Substituting the number six for 'C', assuming no carry from 'H+H', we find that the value of 'I' must be two:

```
  6 H 2 P
+ 6 H 2 P
---------
1 2 6 RO
---------
```

We can now enter the value three for 'H' to give the six in the result. This only leaves 'P', 'R' and 'O' to settle. The value of 'R' is going to be either four or five, depending upon whether, or not, 'P+P' gives any carry. If we test the value four (ie, no carry from 'P+P'), then the minimum remaining value for 'P' is five. We've used all the other lower values, and two fives will give the carry which we don't want! This is no good, so we'll have to try the value five for 'R'. The minimum remaining value for 'P', which gives the necessary carry digit, is seven, making 'O' equal to four. The final substitution is:

```
  6 3 2 7
+ 6 3 2 7
---------
1 2 6 5 4
---------
```

Fairly easy really. You may like to see if there are any further solutions to the above problem before moving on to the next, which is decidedly more difficult. In keeping with the magazine, and moving from addition to multiplication, see if you can deduce the one and only solution to:

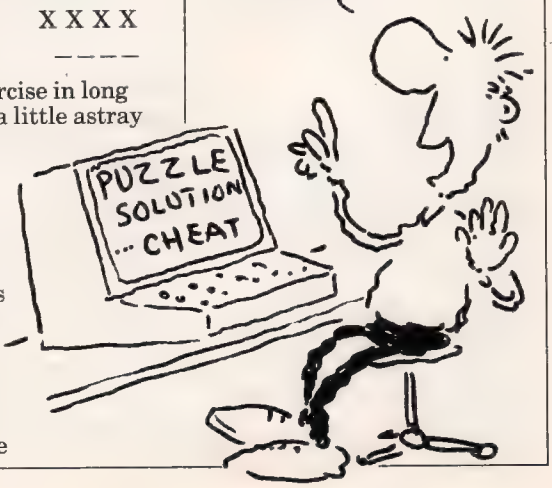



```
    U S E R
  x     Q L
-----------
P U Z Z L E
-----------
```

Now, that last one should have either kept pen to paper into the early hours, or micros whirring away even longer. On the other hand, if you're a masochist, insomniac, or just a smart aleck, this 'ole favourite should keep you going.

```
          X X 8 X X
        -------------
XXX ) X X X X X X X X
        X X X
        -----
          X X X X
            X X X
          -------
          X X X X
          X X X X
          -------
```

The above exercise in long division went a little astray when a malevolent computer substituted almost all the digits for 'X'. The problem is to reconstruct the one and only possible calculation.



If you find this last puzzle a little too difficult, you could always peek. Yes, literally. Try PEEKing the byte location of the square of the ninth prime. This will be the divisor in the above problem. By the way, the prime number sequence starts 1, 2, 3, 5, 7 . . .

As a final quickie let's return to our MICROCHIPs. We know that two CHIPs can make a MICRO, but why not try to find the maximum number of CHIPs possible. To make things relatively easy, you're allowed to use any character/digit for the multiplier. So, for two CHIPs, the obvious choice for the multiplier is 'I' (we've already worked this one out):

```
    C H I P
  x       I
----------
M I C R O
----------

    6 3 2 7
  x       2
----------
1 2 6 5 4
----------
```

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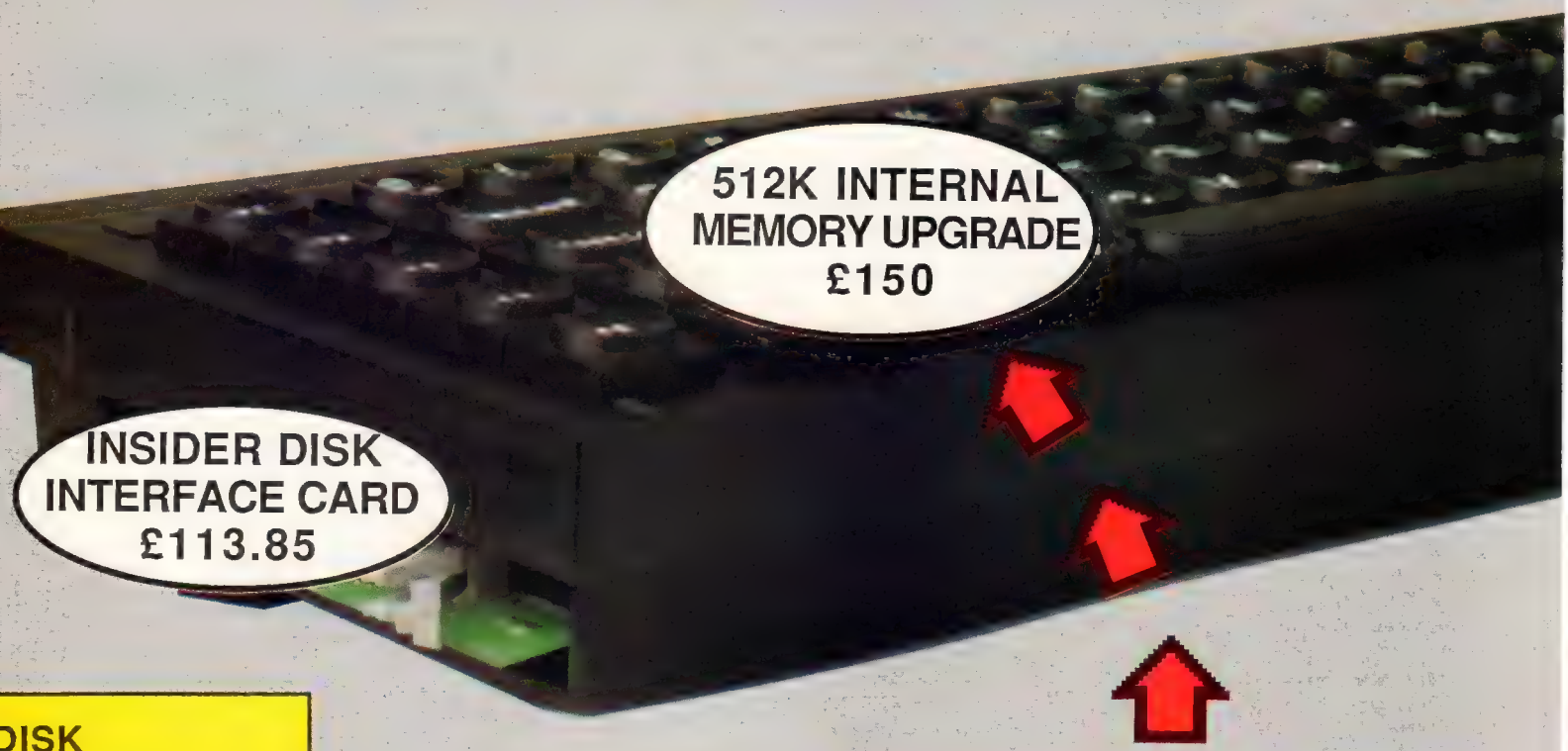

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Musical Squares
M Squires

Musical squares is a memory game where the computer builds up a tune note by note and you have to play it back at each stage. To help you remember the order of the notes one of four coloured squares light up on the screen as the note is played. The game has five levels to cater for everyone.

```
100 REMark ***** Musical Squares 1985 *****
105 REMark **** for QL User by M Squires ****
110 MODE 8:WINDOW 512,256,0,0
120 hi=0:CSIZE 3,0
130 REPeat outer_loop
140 PAPER 7:BORDER 3,2:CLS
150 sto=0:set_up
160 sc=-1:up_score
170 REPeat loop
180 choose_note
190 play
200 IF sto:EXIT loop
210 up_score
220 wait
230 END REPeat loop
240 END REPeat outer_loop
488 LIST
1000 :
1010 DEFine PROCedure set_up
1020 REMark           ------ '
1030 INK 2:AT 5,0
1040 PRINT '  Choose your skill level.'
1050 PRINT '  ------------------------'
1060 INK 1:PRINT \'  Range=1 [Hard] to 5 [Easy]'
1070 INK 0:PRINT \' Press the number you require.'
1080 REPeat ch
1090 IF KEYROW(4)=8:sk=1:EXIT ch
1100 IF KEYROW(6)=2:sk=2:EXIT ch
1110 IF KEYROW(4)=2:sk=3:EXIT ch
1120 IF KEYROW(0)=64:sk=4:EXIT ch
1130 IF KEYROW(0)=4:sk=5:EXIT ch
1140 END REPeat ch:CLS
1150 OPEN #3,scr_60x220a40x18
1160 OPEN #4,scr_272x50a120x18
1170 OPEN #5,scr_272x50a120x188
1180 OPEN #6,scr_60x220a412x18
1190 FOR i=3 TO 6
1200 BORDER #i,2,0
1210 PAPER #i,6:CLS#i
1220 END FOR i
1230 PAPER 0:INK 7
1240 AT 11,0:PRINT 'Z'
1250 AT 11,30:PRINT ','
1260 AT 0,15:PRINT 'C'
1270 AT 24,15:PRINT 'N'
1280 PAPER 7:INK 0
1290 count=0
1300 DIM choice(100)
1310 END DEFine
1320 :
1330 DEFine PROCedure choose_note
1340 REMark           -----------
1350 IF count THEN
1360 FOR num=1 TO count:sound (choice(num))
1370 END IF
1380 count=count+1:choice(count)=RND(3 TO 6)
1390 sound(choice(count))
1400 END DEFine
1410 :
1420 DEFine PROCedure play
1430 REMark           ----
1440 FOR pl=1 TO count
1450 REPeat ch1
1460 k=KEYROW(7)+KEYROW(2)
1470 SELect ON k
1480 ON k=0
1490 GO TO 1460
1500 ON k=2
1510 c=3
1520 ON k=8
1530 c=4
1540 ON k=64
1550 c=5
1560 ON k=128
1570 c=6
1580 END SELect
1590 IF c=choice(pl)THEN
1600 sound(choice(pl))
1610 ELSE finish:sto=1:EXIT pl
1620 END IF
1630 END FOR pl
1640 END DEFine
1650 :
1660 DEFine PROCedure sound(n)
1670 REMark           --------
1680 BEEP (sk*400),n:PAPER#n,n-2:CLS#n:wait:PAPER
#n,6:CLS#n
1690 wait:wait
1700 END DEFine
1710 :
1720 DEFine PROCedure wait
1730 REMark           ----
1740 FOR i=1 TO (sk*20):NEXT i
1750 END DEFine
1760 :
1770 DEFine PROCedure up_score
1780 REMark           --------
1790 sc=sc+1
1800 INK 1:AT 9,9:PRINT 'MUSICAL SQUARES'
1810 INK 2:AT 11,9:PRINT 'Skill level=';sk
1820 INK 0:AT 13,13:PRINT 'Score =';sc
1830 IF sc>hi:hi=sc
1840 AT 14,9:PRINT 'High score=';hi
1850 END DEFine
1860 :
1870 DEFine PROCedure finish
1880 REMark           ------
1890 FOR no=1 TO 3
1900 FOR col=0 TO 7
1910 FOR k=3 TO 6:PAPER #k,col:CLS#k
1920 BEEP 400,RND(3 TO 6)+150
1930 END FOR col
1940 END FOR no
1950 END DEFine
```

Second Sight
Barry Ashfield

This hex loader creates a short multi-tasking program on mdv1_ called G_BACK. When executed (EXEC mdv1_g_back) it allows you to recover the last command typed in. If you make a mistake entering a command simply press <CTRL><G> and edit accordingly. Press <CTRL><X> to suspend the job.

```
10 REMark ********************************
20 REMark *  create code for "g_back"    *
30 REMark * (c) Psientific Sftware 1985 *
40 REMark *       for QL User            *
50 REMark ********************************
100 RESTORE 200
110 start=RESPR(1024):checksum=0
120 FOR f=start TO start+213
130 READ byte:POKE f,byte
140 checksum=checksum+byte
150 NEXT f
160 IF checksum<>14816:PRINT"error in data":STOP
170 DELETE mdv1_g_back
180 SEXEC mdv1_g_back,start,214,64
190 PRINT "g_back saved ok":STOP
200 DATA 96,14,0,0,0,0,74,251,0,6,103,95
210 DATA 98,97,99,107,112,11,114,255
220 DATA 116,1,78,65,36,121,0,2,128,76
230 DATA 50,120,0,222,78,145,74,128,103
240 DATA 250,114,7,97,100,8,1,0,1,103,230
250 DATA 12,1,0,10,103,0,0,152,114,3
260 DATA 97,82,12,1,0,64,102,212,40,10
270 DATA 216,188,0,0,0,16,42,42,0,4
280 DATA 42,106,0,8,44,13,97,96,103,106
290 DATA 12,21,0,10,102,246,97,86,103,96
300 DATA 12,21,0,10,103,6,12,21,0,0
310 DATA 102,240,114,0,96,16,82,141,186
320 DATA 141,102,2,42,68,12,21,0,10,103,66
330 DATA 18,21,50,120,0,224,78,145,74,128
340 DATA 102,238,96,228,71,250,0,30,112,17
350 DATA 38,188,9,1,0,0,55,124,0,0,0,4,23
360 DATA 65,0,6,23,124,0,2,0,7,78,65,78
370 DATA 117,0,0,0,0,0,0,0,0,184,141,102,2
380 DATA 42,69,83,141,188,141,78,117,114,3
390 DATA 97,200,74,1,102,248,96,0,255,74
400 DATA 114,255,112,5,78,65
```

Quickie
Duncan Dunlop

This three line procedure will clear the keyboard buffer of any unwanted keypresses.

```
100 DEFine PROCedure empty_buffer
110 buff=PEEK_L(163916):POKE_L buff+12,PEEK_L(buff
+8)
120 END DEFine empty_buffer
```

(Continued on p.44)

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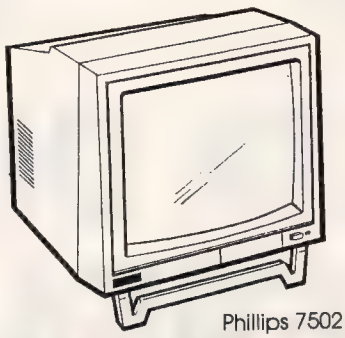

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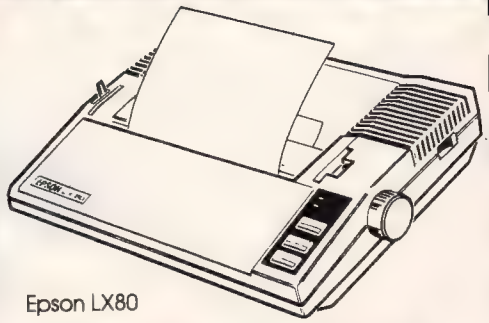

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Home Finance

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QL Home Finance from Buzz Software is designed to avert such a crisis. It provides an easy means of recording, listing and analysing income and expenditure.

Information is recorded in much the same way as it is on a bank statement. That is, as a transaction on an account. Date, payee/payer, amount (+/−), reference no, type of transaction and description should be entered. This information will display in date order in groups of six transactions whenever the account is accessed along with a running balance.

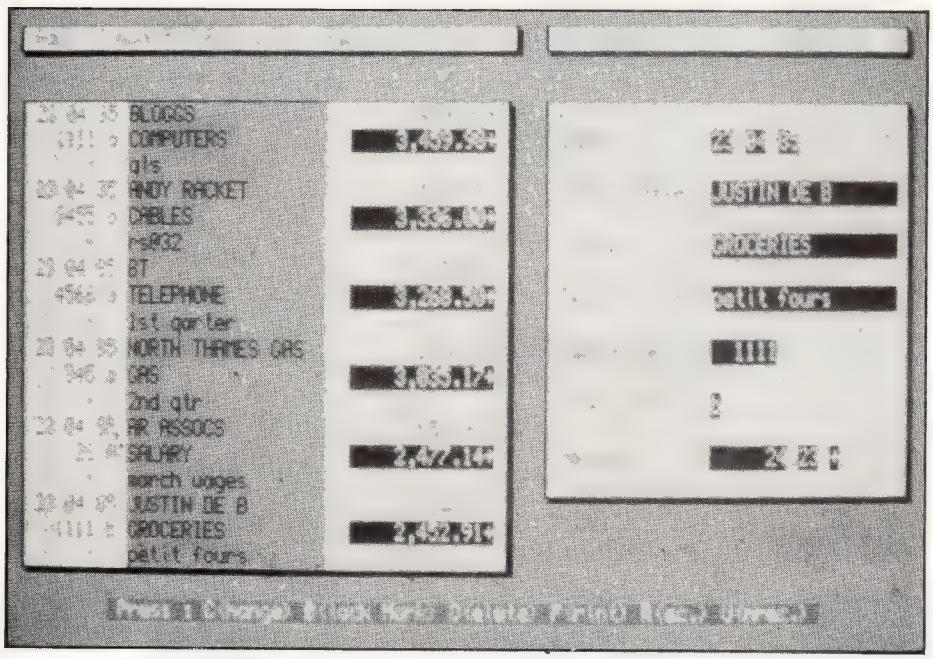
Existing entries may be easily amended and blocks deleted or printed out. Particularly useful, by pressing F1 or F2, information previously in one field may be recalled alphabetically so that where it is repeated, the user need not type it in again.

The program will support both single or double entry. The latter is effected simply by entering an existing account name as the payee or payer on a transaction. The program will automatically post the other side of the entry to that account. For those who cannot be bothered to open accounts for individual debtors or creditors, a facility is included that identifies each single sided entry and opens an account for it.

Standing orders appear as a separate option on the command window. Orders are entered in exactly the same way as transactions, only here the program will automatically debit or credit the appropriate accounts on the due dates, either monthly or annually.

The program's analysis feature allows you to review balances on accounts or selected items of income and expenditure. In the latter case you can total or itemise transactions by account, type, description and even by operator ID (so that you can keep track of who entered what). A separate option permits the user to define his own groups as well as change or merge existing classifications.

For those who want to keep their personal finances under a tight rein, *QL Home Finance* is an attractive proposition. Operating procedures, well documented in a miniature manual, are easy to comprehend and quickly mastered. Loading times are short and printer installation, simple. Backup routines and file update procedures allow for device names to be varied and in common with other facilities are virtually idiot-proof. In all, a package that will be welcomed by anyone who finds sifting through hastily written cheque stubs, dog-eared receipts and crumpled credit card slips an unavoidable chore.



A typical update screen on Home Finance.

Transact

Dialog Software's *Transact* takes as its model the traditional manual bookkeeping system built around a nominal ledger and supported by books of prime entry – bank, cash and purchase and sales 'day' books.

The accounting process is broken down into two distinct parts. Transaction Entry and Nominal Ledger Update or 'posting'. During the Entry process, details of payments, receipts, invoices and credit notes are entered into the appropriate book, amounts analysed out in full according to pre-defined nominal headings and then everything is saved to a 'transaction' file on microdrive. During the Update process the program calculates the file total for each nominal heading and amends the balance on the appropriate account accordingly.

From the point of view of the programmer the idea of storing detailed information in numerous transaction files and only storing running balances in a single accounts file is exceedingly attractive as it greatly reduces memory overheads. However, for the user it complicates record keeping and makes it very much more difficult to extract meaningful reports.

However, not only must we limit Transact's user base to accountants but we must also limit it to those experienced in programming. The program, which incidentally is written entirely in SuperBasic, is particularly unfriendly. Menus are inconsistent, options are slow to take effect, there are few helpful prompts and virtually no standardised key strokes. Even worse the program has a habit of crashing when some unforeseen input has been typed in or where a device, such as microdrive, is acting up. To their credit Dialog do warn users that certain inputs may be fatal and suggest entering CONTinue in such an event. In our case this generated an 'out of memory' error. Some consolation!

Overall, Transact does not meet the standards required of a comprehensive business accounting system, but fills a gap in present market and may be commended for that.

[redacted]

***Dialog Software**, 20 New Row, London WC2*
Transact: £34.95

***Sinclair Research**, Stanhope Road, Camberley, Surrey*
QL – Home Finance: £24.95

GRAPHICS ON DISPLAY

Ian Stewart takes Euclid into the 20th Century and applies a few simple formulae.

If the data representing a picture can be stored in the computer's memory, then it can also be manipulated. The picture can be stretched, twisted, rotated, moved sideways, or turned upside down. Colours can be changed and multiple copies made. Here we design a program, called *EuQLid*, which will allow us to carry out each operation with comparative ease.

Ignoring advanced features such as FILL, all computer-generated line drawings consist of a number of *straight* segments drawn between points. Circles and curves are made up of a very large number of very short segments. It follows then, that we can list the x and y coordinates of all the points and also specify which segment goes where. For instance we could number each point, and then say 'draw point 3 to point 4; join point 1 to point 2 . . . ' and so on.

As a simple example consider *Figure 1*, which has four points

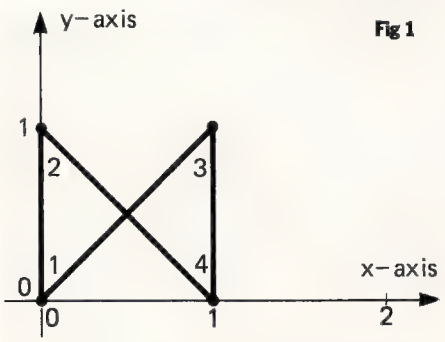


Fig 1

labelled (1 to 4) joined by four lines. The x and y coordinates of each point may be stored in two one dimensional arrays $x(a)$ and $y(n)$. As there are only four points to store there will be only 4 elements in each array (ie $1 \leq n \leq 4$ *see fig 2*).

x(1) = Ø
x(2) = Ø
x(3) = 1
x(4) = 1

Fig 2

y(1) = Ø
y(2) = 1
y(3) = 1
y(4) = Ø

In order to record which points are joined together we define a 4×4 array *c(m,n)*, known as the 'incidence' matrix of the picture. The entries are made as follows:

c(m,n) = 1	if point m is joined to point n
c(m,n) = Ø	if point m is not joined to point n

In our example, the following pairs of points are joined:

[1 to 2]	[1 to 3]
[2 to 1]	[2 to 4]
[3 to 1]	[3 to 4]
[4 to 2]	[4 to 3]

Each line is included twice, because it has two ends! So the incidence matrix looks like this:

c(m,n)	n→ 1	2	3	4
m 1	Ø	1	1	Ø
m 2	1	Ø	Ø	1
m 3	1	Ø	Ø	1
m 4	Ø	1	1	Ø

Just to make it clear: the entry *c(3,2)*, say (in row 3, column 2) is 0. That says point 2 is NOT joined to point 3. Whereas the entry *c(3,4)* is 1, because point 3 IS joined to point 4.

POINT TO POINT

Having worked out a method for storing picture data we can now embark up designing our program. First we need a procedure to set up arrays that will store such data.

```
500  DEFine PROCedure initialize
510    INPUT#0,"number of points?"!np
520    DIM x(np),y(np),u(np),v(np),c(np,np)
530    CLS:CLS#0
540  END DEFine initialize
```

Next, a general input routine which will allow you to specify the design you wish to have drawn:

```
1000 DEFine PROCedure set_up
1010   LOCal h,i,t
1020   PRINT "number","x-coord","y-coord"
1030   PRINT
1040   FOR t=1 TO np
1050     INPUT#0,"x-coordinate"!x(t):PRINT t,x(t),
1060     INPUT#0,"y-coordinate"!y(t):PRINT y(t)
1070   END FOR t
1080   FOR t=1 TO np
1090     INPUT#0,"#"&t&" connects to:";con$
1100     IF con$="" THEN NEXT t
1110     ptr1=1:ptr2=1
1120     REPeat loop
1130       REPeat search
1140         IF con$(ptr2)=" " THEN EXIT search
1150         ptr2=ptr2+1
1160         IF ptr2>LEN(con$) THEN EXIT search
1170       END REPeat search
1180       k=con$(ptr1 TO ptr2)
1190       c(t,k)=1:c(k,t)=1
1200       ptr1=ptr2:ptr2=ptr2+1
1210       IF ptr2>LEN(con$) THEN EXIT loop
1220     END REPeat loop
1230   END FOR t
1240 END DEFine set_up
```

A word of explanation may be in order here. This **set-up** first allows you to input the coordinates $x(t),y(t)$ of the *np* points you have chosen. It displays these, numbered in order according to the value of t. For each point, you then specify a string *con$* which lists all the points it is connected to. For example, suppose you want point 11 to be connected to points 1,2,5,7,9,14,15,16. Then in answer to the prompt '#11 connected to:' you input '1 2 5 7 9 14 15 16' as a single string. Use spaces to separate the numbers.

Our next procedure **sketch** draws the diagram. You can specify the ink colour *col*, and the size of *blob* to be drawn at each point. (If you don't want blobs, use size zero. The blobs are to make the process more vivid, and to add some interest to the resulting designs.)

```
2000 DEFine PROCedure sketch(blob,col)
2010   LOCal t
2020   INK col
2030   FOR t=1 TO np
2040     FILL 1
2050     CIRCLE x(t),y(t),blob
2060     FILL 0
2070     FOR l=1 TO np
2080       IF c(t,l)=1 AND t<l THEN
2090         LINE x(t),y(t) TO x(l),y(l)
2100       END IF
2110     END FOR l
2120     IF blob>0 THEN
2130       INK 0
2140       CIRCLE x(t),y(t),blob
2150       INK col
2160     END IF
2170   END FOR t
2180 END DEFine sketch
```

As a further refinement, we'll incorporate a polygon routine. This one has an extra parameter, *web*. If *web* is set to 1 then the computer joins every vertex to every other vertex; if *web* is anything else, you get the usual polygon.

```
3000 DEFine PROCedure polygon(nv,web)
3010   LOCal t
3020   np=nv
3030   FOR t=1 TO nv
3040     x(t) = COS(2*t*PI/nv)
3050     y(t) = SIN(2*t*PI/nv)
3060     c(t-1,t)=1:c(t,t-1)=1
3070   END FOR t
3080   c(1,nv)=1:c(nv,1)=1
3090   IF web=1 THEN
3100     FOR t=1 TO nv
3110       FOR l=1 TO nv
3120         c(t,l)=1
3130       END FOR l
3140     END FOR t
3150   END IF
3160 END DEFine polygon
```

With procedures **initialize, set-up, sketch** and **polygon** typed in we are now in a position to map out any diagram to the computer's screen and store it in memory. The next step is to move it around the screen.

MAKING MOVES

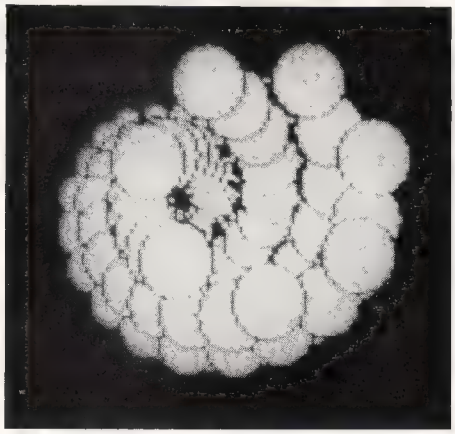
The simplest kind of motion to perform is one that slides the picture in some direction, without turning it. Such a move is called a *translation*. If the translation moves *xt* units sideways and *yt* units upwards, then coordinates of points change like this:
$x \rightarrow x+xt$
$y \rightarrow y+yt$.
The procedure to do this is:

```
4000 DEFine PROCedure translate(xt,yt)
4010   LOCal t
4020   FOR t=1 TO np
4030     x(t)=x(t)+xt
4040     y(t)=y(t)+yt
4050   END FOR t
4060 END DEFine translate
```

Reflections (as in a mirror) are also easy to accomplish. The only one we'll make use of is a reflection in the y-axis. This sends
$x \rightarrow -x$
$y \rightarrow y$.
Once more the algorithm is very easy to construct.

```
4500 DEFine PROCedure reflect
4510   LOCal t
4520   FOR t=1 TO np
4530     x(t)=-x(t)
4540   END FOR t
4550 END DEFine reflect
```

Rotating a diagram about the origin



A spiral: Two simple operations!

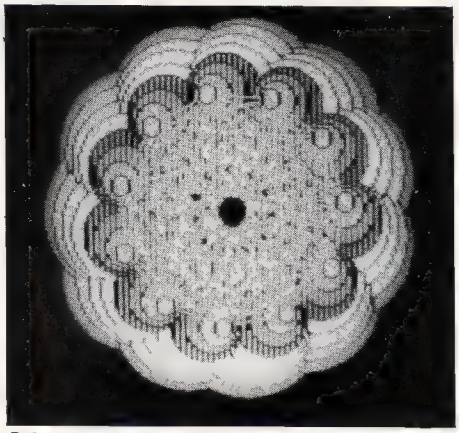
by an angle of θ (theta) is more complex. Coordinates change in a way that would appeal only to a geometer:
$x \rightarrow x \cos\theta - y \sin\theta$
$y \rightarrow x \sin\theta + y \cos\theta$
This leads to:

```
3500 DEFine PROCedure rotate(theta)
3510   LOCal t
3520   FOR t=1 TO np
3530     u(t) = x(t)*COS(theta)-y(t)*SIN(theta)
3540     v(t) = x(t)*SIN (theta)+y(t)*COS (theta)
3550     x(t)=u(t):y(t)=v(t)
3560   END FOR t
3570 END DEFine rotate
```

All the above operations are 'rigid' motions: they leave the shape and size of the picture unchanged. In fact every rigid motion in the plane can be performed as a succession of reflections, rotations, and translations. If the shape stays the same, but the size changes, the move is called a *similarity* or *dilation. If the size is to be scaled by a factor dil,* then *x* and *y* change like this:
$x \rightarrow dil*x$
$y \rightarrow dil*y$
More generally, we could stretch by different amounts in each direction:
$x \rightarrow dilx*x$
$y \rightarrow dily*y$
Now we get:

```
5000 DEFine PROCedure dilate(dilx,dily)
5010   LOCal t
5020   FOR t=1 TO np
5030     x(t)=dilx*x(t)
5040     y(t)=dily*y(t)
5050   END FOR t
5060 END DEFine dilate
```

Whilst on their own the procedures to manipulate a diagram may seem simple, combined they form a powerful and adaptable utility. Our EuQLid program, for example, could be supplied with a host of 'driver' routines to enable extremely complex manipulations. Here, you must always start by specifying the SCALE, and using **initialize** to



Polygon and web combined!

create suitably sized arrays. After that you can use **set-up** to custom design your own diagram; or use **test** or **polygon.** Then you can move the design around using combinations of **rotate, translate, reflect, dilate.**

To get you started, here are some sample 'drivers'.

```
90 MODE 4
100 PAPER 1:INK 6:CLS
110 SCALE 8,-6,-2.5
120  initialize
125 polygon np,1
130 FOR p = 1 TO 13
140 translate .2,-.1
150 rotate .3
175 dilate .96,1.2
180    sketch .3,RND(25)
200  END FOR p
```

```
100  PAPER 0:INK 7:CLS
110  SCALE 10,-8,-5
120  initialize
130  polygon np,0
140  dilate 3,3
150  FOR p=16 TO 0 STEP -2
160    sketch p/8,145-p
170    rotate 5E-2
180  END FOR p
```

```
100  PAPER 0:INK 7:CLS
110  SCALE 30,-24,-15
120  initialize
130  polygon np,0
140  dilate 2,2
150  translate 1,1
160  FOR p=3 TO 20
170    dilate 1.05,1.08
180    rotate PI/10
190    sketch p/10,p MOD 7+1
200  END FOR p
```

```
100  PAPER 0:INK 7:CLS
110  SCALE 30,-24,-15
120  initialize
130  set_up
140  dilate 2,2
150  translate 1,1
160  FOR p=3 TO 20
170    dilate 1.05,1.08
180    rotate PI/10
190    sketch p/10,p MOD 7+1
200  END FOR p
1025   PRINT "coordinate values
       between -2.00 & +2.00"
```

PROTECT AND SURVIVE

Is your software secure? Alan Turnbull shows that it isn't but reveals how it can be!

The idea of protecting software appeals to an extraordinarily broad range of users. For the software house, at the very top of the scale, it's used to safeguard costly investments from criminal exploitation by unscrupulous third parties – better known as 'pirates'. For the programmer, it helps keep secret the fruit of many hours hard work in developing revolutionary algorithms. For the businessman it provides a means of denying access to sensitive information. And finally, for the aspiring amateur it provides a useful cover for incompetent code.

As input and output under QDOS is 'device independent', program protection is something of a problem. Any file, say, on microdrive or disk may be easily copied to printer, screen or any other microdrive cartridge or disk. This is especially true of SuperBasic programs which are stored as pure ASCII files so that the simple command

COPY mdv1_filename TO scr_

will reveal all in a form that is instantly legible.

As regards machine code, though this needs to be disassembled, the fact that QDOS permits bytes to be pulled out of any place in memory using the **SBYTES** command and loaded back in to an entirely different location using **LBYTES** makes this a very simple matter.

So the QL program protector must devise special – some would say 'sneaky' – methods of making a program run only when it is an original or making the copying process as hard as possible. In this article, we examine some methods available.

The loading of commercial programs from the medium on which they are supplied (Microdrive cartridge), into memory so that they may run is usually done by a *boot* file. On the QL, immediately after one of the function keys has been pressed to select the picture format, the machine attempts to open a channel to a device called **BOOT**. This may be a list of commands held in ROM. If this is not found, an attempt is made to open a file for input called *BOOT* on Microdrive 1. This file, which must consist of a list of SuperBasic lines in ASCII, will typically load in more SuperBasic programs and/or machine code and will include a statement to **CALL** this machine code.

This mechanism revolves around the system variable called **BV_COMCH**. This variable is addressed in machine code by **$0084(A6)** and holds a long word representing the channel ID for the command input stream. Normally it holds zero for the standard keyboard entry channel but on booting the machine or issuing a **LOAD** command, it holds the channel ID for opened file.

Instead of following the normal booting procedure described above, the pirate would probably just

LOAD mdv1_boot

and list the SuperBasic program to find-out more information. But as the file is a list of commands which do not need line numbers, the boot file could be made to auto-run even when LOADed or MERGEd.

An example program to set up a suitable boot file is given below.

Listing 1

```
130 OPEN_NEW #4,mdv1_boot
140 PRINT #4,"REPeat loop1"
150 PRINT #4,"  PAPER RND(0 TO 7)1"
160 PRINT #4,"  PRINT 'Try pressing <BREAK>'"
170 PRINT #4,"END REPeat loop"
180 CLOSE #4
```

Try LOADing or MERGEing the resultant boot file pressing 'break' (CTRL+ SPACE), and then issuing the command LIST – you will find that the program has disappeared because it wasn't a proper program anyway: it was just a list of commands input from the Microdrive cartridge rather than the keyboard. This method can be used for any SuperBasic program – it does not have to be called *BOOT* and need not be stored in Microdrive 1.

Although the above method can temporarily trick the pirate, he or she may still use the COPY command itself. In this case we must make a vital file 'invisible' so that it does not appear in the directory. This may be done by saving a file with a command such as

SBYTES mdv1_,0,49152

This would save the ROM contents on Microdrive 1 with a null file name. When a **DIR mdv1_** is done, the directory shows no file but the number of free sectors will have obviously reduced.

This method can be used to greatest effect when loading another file from within the machine code. A dummy file name (which when loaded might crash the machine) may be given that has a character count of zero POKEd-in. The pirate would hopefully be fooled by reading this loader file and would attempt to load and run the dummy file unaware the zeroed character count and, of course, the machine would crash hopefully destroying his or her previous efforts, thereby inducing frustration. The drawback with this method is that only one 'invisible' file may be stored on a cartridge.

Alternatively, you may choose to store files with names like 'mdv1_<SPACE>' – these may not be copied unless the file name is given in a string because the QL's coercion mechanism cannot cope with the space after the underscore.

One of the most popular methods of foiling the software pirate is to 'disable' the break key. On the QL, there is no special system variable to enable/disable the break key although with the latest QL ROM release – version 'JS' – an attempt has been made to vector the keyboard decode routine. This is the routine that decodes into character codes the different combinations of KEYROW values passed from the Intel i8049 (Intelligent Peripheral Controller) secondary processor. Unfortunately, the Sinclair programmers have placed the vector in ROM so that it cannot be altered. Never mind, perhaps they'll get it right next time!

The keyboard is scanned every 20 ms under interrupts generated by one of the QL's ULAs. Thankfully, this interrupt mechanism is vectored with the linked-list pointer held in **SV_PLIST** (at address $2803C). This long word points to a 8 byte table. The first 4 bytes represent a long word pointer to the next item in the linked-list. The next 4 bytes are the long word pointer to the current 50Hz interrupt server. Upon power-up, the unexpanded QL has just one entry in this linked-list. This routine, called under interrupts, deals with all external interfacing on the QL by communicating with the main ULAs and the Intelligent Peripheral Controller.

It is therefore simple to disable the break key from within SuperBasic – you just issue the command

POKE_L 163900,0

which tells QDOS to ignore the outside world by emptying the linked-list. Doing this will affect any extra hardware you have attached which uses 50Hz interrupts. The method is only of use within simple SuperBasic programs although the keyboard may be read using KEYROW (for example, for reading cursor or function keys).

A more useful way of disabling the break key may be done by linking-in an extra scheduler loop task – this is a routine which gets called every

P R O T E C T

time the QDOS job scheduler is invoked. The mechanism is of great use because all such routines are called before ROM-resident ones.

In order to disable the break key we have to make sure that the system variable **BV_BRK** at **$008F(A6)** is never zeroed and that the SuperBasic job status is never set to 'suspended'. Also, the effect of *<CTRL> <F5>* must be disabled by ensuring that the screen is always 'active' by setting the system variable associated with this accordingly.

The assembly language routine shown in *Listing 2* sets up a schedul-

Listing 2

```
MT_LSCHD    EQU     $1E             TRAP #1 key to link-in a scheduler loop task
BASIC_HEADER EQU    $A8             Size of SuperBASIC job header (offset from BV_BASIC)
BV_BRK      EQU     $008F           Offset of break key flag in BV area
JB_STAT     EQU     $0014           Offset of job status flag in job header
SV_BASIC    EQU     $28010          Address of SuperBASIC job header
Sv_SCRST    EQU     $28033          Address of screen status flag
WAITING     EQU     -2              Job status for  waiting for other job to finish

* Start of code

            LEA     TASK,A1         Point to new scheduler loop task
            LEA     TASK_LINK,A0    Point to link space
            MOVE.L  A1,4(A0)        Store task pointer in second long word
            MOVEQ   #MT_LSCHD,D0    TRAP #1 key to link-in task
            TRAP    #1              Do manager TRAP
            RTS                     Return to SuperBASIC

* Scheduler loop task to be linked-in

TASK        MOVEA.L SV_BASIC,A0     Get address of SuperBASIC job header
            LEA     BASIC_HEADER(A0),A1  Get address for A6 (start of BV area)
            TAS     BV_BRK(A1)      Signal 'break key not pressed
            TST.W   JB_STAT(A0)     Test SuperBASIC job status
            BGE.S   NO_ALTER        Don't alter it if SuperBASIC is not suspended
            MOVE.W  #WAITING,JB_STAT(A0) Otherwise signal  waiting for other job to finish'
NO_ALTER    CLR.B   SV_SCRST        Ensure screen is active
            RTS                     Return from this task

* Reserve link storage

TASK_LINK   DS.L    2

            END
```

er loop task which makes sure **BV_BRK** never holds zero (thereby preventing QDOS from realising that the break key has been pressed) and checks for the SuperBasic job status and alters it accordingly. The routine works because it is called before scheduler loop tasks in ROM which include the break sequence.

The Motorola MC68008 'TAS' (test and set) instruction used actually tests and sets bit 7 of the operand byte in one indivisible operation. (This is a neater way of signalling break has not been pressed rather than loading $80 into the system variable. Here, the test part of the operation is ignored).

The routine may be incorporated into your 'boot' file set-up using the method described above and an example complete with machine code loader for the benefit of those without assemblers is given in *Listing 3*.

The best protection device on the

Listing 3

```
130 LET reserved_address=RESPR(60)
140 LET address=reserved_address
150 RESTORE
160 REPeat read_and_store_machine_code
170   IF EOF THEN EXIT read_and_store_machine_code
180   READ machine_code_byte
190   POKE address,machine_code_byte
200   LET address=address+1
210 END REPeat read_and_store_machine_code
220 CALL reserved_address
230 PRINT #0,"Now try pressing break..."
240 REPeat forever
250   FOR border_width=99 TO 0 STEP -4
260     BORDER border_width,RND(0 TO 7)
270   END FOR border_width
280 END REPeat forever
290 :
300 DATA  67, 250,   0,  16,  65, 250,   0,  46,  33,  73
310 DATA   0,   4, 112,  30,  78,  65,  78, 117,  32, 121
320 DATA   0,   2, 128,  16,  67, 232,   0, 104,  74, 233
330 DATA   0, 143,  74, 104,   0,  20, 108,   6,  49, 124
340 DATA 253, 254,   0,  20,  66,  57,   0,   2, 128,  51
350 DATA  78, 117,   0,   0,   0,   0,   0,   0,   0,   0
```

QL, apart from using ROM cartridges, seems to be that of forcing the software purchaser to keep the original cartridge in, say, Microdrive 2 whilst a user-made copy is run in Microdrive 1.

This may be done by spinning the cartridge in mdv2 and reading a sector header. From this header, the 16-bit random number may be obtained which was recorded during the FORMAT procedure. If the number recorded on the original cartridge is read at the time of creation and noted in a table in the loader of the program which needs protecting, this loader may compare it with the number read from the cartridge in mdv2. If it is not the same, or there is no cartridge present, a system reset or other nasties will come into effect. Otherwise the loader will continue to load the main program.

Of course, the pirate still has a 1 in 65536 chance of formatting his or her own cartridge with the same 16-bit random number as the original cartridge!

The MC68008 assembly language needed to read a sector header and a demonstration SuperBasic program are given in *Listings 4* and *5* respectively. The latter includes the machine code (in DATA statements) which will write the random number to a cartridge in Microdrive 1 and then invite you to place it or another cartridge in Microdrive 2. It will tell you whether it is the same cartridge (subject, of course, to the 1 in 65536 chance mentioned above).

Listing 4

```
PC_TCTRL    EQU     $18002          Transmit control hardware register
PC_MCTRL    EQU     $18020          Microdrive control hardware register
SV_TMODE    EQU     $28040          IX8302 ULA transmit mode register
MD_SECTR    EQU     $012A           vector to read a sector header (indexed by $4000)
MOTORS_OFF_AH EQU   $285A           Address in 'AH  ROM (QDOS v1.02)
MOTORS_OFF_JM EQU   $286A           As above but for 'JM  (QDOS v1.03)
MOTORS_OFF_JS EQU   $2C50           As above but for 'JS  (QDOS v1.10)
MOTORS_OFF_JSU EQU  $2C9A           As above but for 'JSu' (QDOS v1U10)
MOTORS_OFF_MG EQU   $2CCC           As above but for 'MG  (QDOS v1.13)
MOTOR_ON_AH EQU     $2B64           Address in 'AH  ROM of  Microdrive motor on  routine
MOTOR_ON_JM EQU     $2B70           As above but for 'JM'
MOTOR_ON_JS EQU     $2C56           As above but for 'JS
MOTOR_ON_JSU EQU    $2CA0           As above but for 'JSU'
MOTOR_ON_MG EQU     $2CD2           As above but for 'MG'
TIME_OUT    EQU     1000            'Time-out' value for reading sector header
PC_NOTMD    EQU     %11100111       PC_TCTRL register mask for not Microdrive mode
PC_SERB     EQU     %00010000       PC_TCTRL register value for serial I/O
INTS_OFF    EQU     %0000011100000000  SR value for 'interrupts off'
INTS_ON_USER EQU    %1110110001111111  SR mask for 'interrupts on' and 'user mode'
ERR_OK      EQU     0               'No error' return to SuperBASIC
ERR_NF      EQU     -7              'Not found  error return
ERR_EF      EQU     -16             'Bad or changed medium' error return
* Start of routine to read a sector header from Microdrive cartridges.
* CALLed with Microdrive number 1-8 in D1.
            TRAP    #0              Enter 'Supervisor' mode
            CMP.L   #9,D1           Microdrive number >= 9?
            BGE.S   NOT_FOUND       Yes - report error
            TST.L   D1              No - Microdrive number = 0?
            BEQ.S   NOT_FOUND       Yes - report error
            ORI.W   #INTS_OFF,SR    No - turn interrupts off
            LEA     PC_MCTRL,A3     Point to Microdrive control register
            MOVE.B  #PC_NOTMD,D0    PC_TCTRL bits except Microdrive mode
            AND.B   SV_TMODE,D0     Perform mask on IX8302 ULA transmit mode register
            ORI.B   #PC_SERB,D0     Signal 'Microdrive turning
            MOVE.B  D0,PC_TCTRL     Set value for transmit control register
            MOVE.B  D0,SV_TMODE     Same for IX8302 ULA transmit mode register
            MOVEA.L #MOTOR_ON_JS,A0 Turn Microdrive motor on (number in D1)
            JSR     (A0)
            MOVE.W  #TIME_OUT,D3    Set-up time-out for reading a sector header
BAD_HEADER  SUBQ.W  #1,D3           Decrement - time-out exhausted?
            BEQ.S   BAD_MEDIUM      Yes - report error
            LEA     HEADER_BUFFER,A1  No - point to buffer for sector header
            MOVEA.W #D_SECTR,A0     vector for reading a sector header
            JSR     $4000(A0)
            BRA.S   BAD_MEDIUM      Return here means 'bad or changed medium' error
            BRA.S   BAD_HEADER      Return here means sector header flag (#FF) not found
            MOVEQ   #ERR_OK,D7      Return here means finished o.k.
            BRA.S   FINISH          Jump to end
NOT_FOUND   MOVEQ   #ERR_NF,D7      Signal 'not found  error
            BRA.S   QUIT            Jump to end - no need to turn motors off, etc.
BAD_MEDIUM  MOVEQ   #ERR_EF,D7      Signal 'bad or changed medium' error
FINISH      MOVEA.L #MOTORS_OFF_JS,A0  Turn all Microdrive motors off
            JSR     (A0)
            MOVE.B  #PC_NOTMD,D0    PC_TCTRL bits except Microdrive mode
            AND.B   SV_TMODE,D0     Perform mask on IX8302 ULA transmit mode
            MOVE.B  D0,PC_TCTRL     Store back in transmit control register
            MOVE.B  D0,SV_TMODE     ... and in IX8302 ULA transmit mode register
QUIT        ANDI.W  #INTS_ON_USER,SR  Turn interrupts on and set 'User  mode
            MOVE.L  D7,D0           Store error return number
            RTS                     Return to SuperBASIC (reporting any error)
* Reserve storage for sector header
HEADER_BUFFER
F_AG        DS.B    1               Special sector header flag (#FF)
SECTOR_NUMBER DS.B  1               Number of sector following header
NAME        DS.B    10              Cartridge name padded-out with spaces
RAND_NUMBER DS.W    1               16-bit random number stored during FORMAT procedure
            END
```

The ROM routines to start-up single, and turn-off all, Microdrive motors are unfortunately not vectored as the ones to read sector headers. Hopefully this might be changed in future versions of QDOS.

All this has meant we need to provide the addresses for the routines for every ROM release – these are 'AH' (QDOS version 1.02), 'JM' (1.03), 'JS' (1.10), 'MG' (1.13) and 'JSU' (1U10). The last one is the US version of the 'JS' ROM (and if you have either 'FB' or 'PM' – both are obsolete and no longer supported – you should immediately return your QL to Sinclair). Your ROM release code is returned by the SuperBasic string function VER$. *Listing 4* should be assembled substituting the correct addresses for your ROM release. *Listing 5* automatically POKEs the correct addresses into the routine.

Listing 5

```
130 MODE 4
140 LET reserved_address=RESPR(144)
150 LET address=reserved_address
160 RESTORE
170 REPeat read_and_store_machine_code
180   IF EOF THEN EXIT read_and_store_machine_code
190   READ machine_code_byte
200   POKE address,machine_code_byte
210   LET address=address+1
220 END REPeat read_and_store_machine_code
230 LET rom_ver$=VER$
240 IF rom_ver$(1 TO 2)='PM' OR rom_ver$='FB' THEN
250   PRINT "Return QL to Sinclair"
260   STOP
270 END IF
280 IF rom_ver$(1 TO 2)='AH' THEN
290   POKE_W reserved_address+54,11108
300   POKE_W reserved_address+96,11102
310 END IF
320 IF rom_ver$(1 TO 2)='JM'
330   POKE_W reserved_address+54,11120
340   POKE_W reserved_address+96,11114
350 END IF
360 IF rom_ver$(1 TO 3)='JSU'
370   POKE_W reserved_address+54,11424
380   POKE_W reserved_address+96,11418
390 END IF
400 IF rom_ver$(1 TO 2)='MG'
410   POKE_W reserved_address+54,11474
420   POKE_W reserved_address+96,11468
430 END IF
440 IF rom_ver$(1 TO 2)<>'JS'
450   PRINT "New ROM - contact me through QL User"
460   STOP
470 END IF
480 REPeat test_microdrive_cartridges
490   PRINT "Place a cartridge in mdv1 and press a key"
500   PAUSE
510   CALL reserved_address,1
520   LET mdv_one_number=PEEK_W(reserved_address+132)
530   PRINT "Place a cartridge in mdv2 and press a key"
540   PAUSE
550   CALL reserved_address,2
560   LET mdv_two_number=PEEK_W(reserved_address+132)
570   IF mdv_one_number=mdv_two_number THEN
580     PRINT "Cartridge in mdv2 same as that in mdv1"
590   ELSE
600     PRINT "Cartridge in mdv2 not the same as in mdv1"
610   END IF
620 END REPeat test_microdrive_cartridges
630 :
640 DATA  78,  64, 178, 188,   0,   0,   0,   9, 108,  76
650 DATA  74, 129, 103,  72,   0, 124,   7,   0,  71, 249
660 DATA   0,   1, 128,  32,  16,  60,   0, 231, 192,  57
670 DATA   0,   2, 128, 160,   0,   0,   0,  16,  19, 192
680 DATA   0,   1, 128,   2,  19, 192,   0,   2, 128, 160
690 DATA  32, 124,   0,   0,  44,  86,  78, 144,  54,  60
700 DATA   3, 232,  83,  67, 103,  24,  67, 250,   0,  62
710 DATA  48, 120,   1,  42,  78, 168,  64,   0,  96,  10
720 DATA  96, 236, 126,   0,  96,   6, 126, 249,  96,  32
730 DATA 126, 240,  32, 124,   0,   0,  44,  80,  78, 144
740 DATA  16,  60,   0, 231, 192,  57,   0,   2, 128, 160
750 DATA  19, 192,   0,   1, 128,   2,  19, 192,   0,   2
760 DATA 128, 160,   2, 124, 216, 255,  32,   7,  78, 117
770 DATA   0,   0,   0,   0,   0,   0,   0,   0,   0,   0
780 DATA   0,   0,   0,   0
```

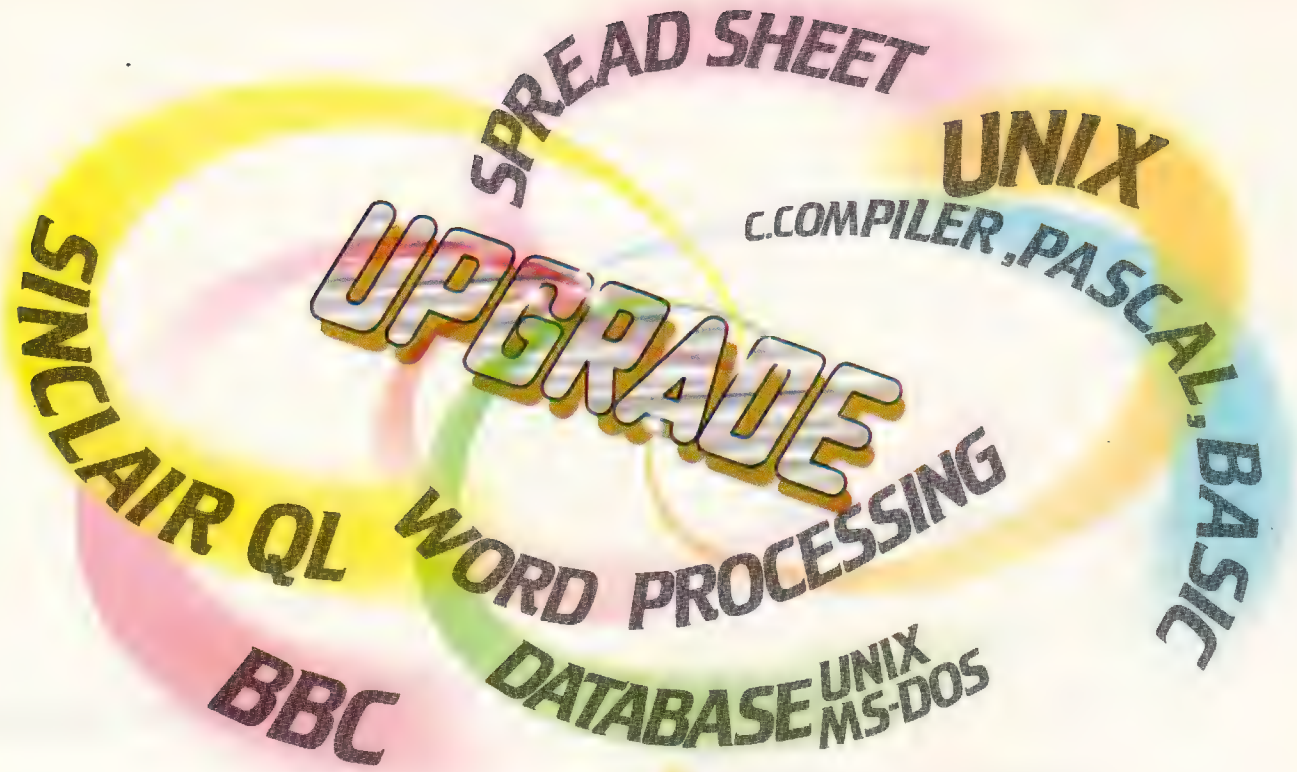
ADDENDUM: Since printing the above we have found some missing lines. To correct this add the following to the program:

275 LET rom_recog=0

and then the line **LET rom_recog=1** at line numbers **305**, **345**, **385** and **425**. Now replace line **440** with:

440 IF rom_recog=0

P R O T E C T



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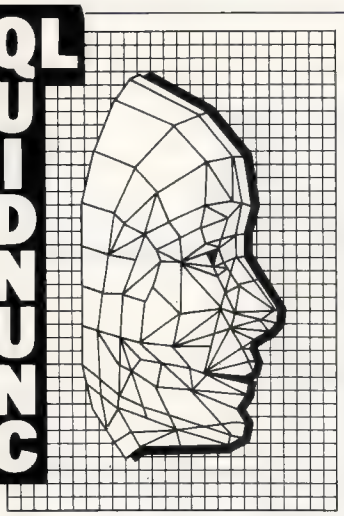


As one shady character departs for pastures anew, another takes their place. So, a new Silhouette with a similar brief – to root out and reveal the best in QL rumour.

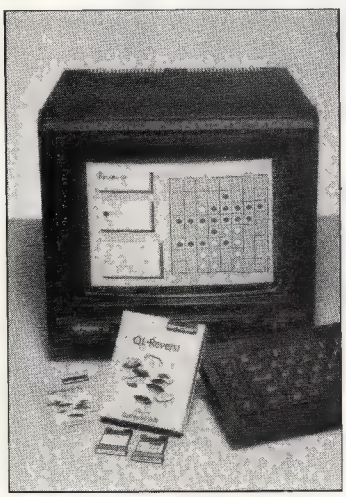
The Swedish Saga, it would appear, goes on and on . . . Basingfjord – the emmigres answer to Dallas – still dominates the (over)ratings. Mystery, drama and suspense are all there, set against a background of microelectronic madness. Will the so-called definitive expansion system ever go into volume production? Is performance simply an accounting term and delivery a medical problem? Is an interface in the hand better than four freebies and a dual disk system in the post? And, most important of all, are these questions rhetorical or will somebody ever answer one of the many phones connected to the problem?

Mystery surrounds the Sinclair printer. What will it be? Well, if you have an American Express card and live in the States, not only will you still be paying full price for a QL – *that'll do nicely* – but will have also seen the printer advertised alongside the QL for the last two months. And what it it? A black box boldly displaying the Sinclair logo and concealing one Seikosha NLQ dot matrix printer (*probably!*).

What of the PCW Show! Sinclair had the same old stand they had at the Which Computer show populated by ageing Spectrums and now officially 'cheap' QLs. What new software there was did nothing to advance the cause of 68000 programming: a game of Reversi that looked as if it had been gleaned from a readers program and a rendering of Asteroids that doesn't do justice to its authors. Are Sinclair so desperate for software that they'll badge anything that moves? More importantly, where do they go from such a strange position?

The good news is . . . wait for it . . . British Telecom has entered the QL games market, albeit indirectly through Firebird Software; purveyor of blockbuster games (Gold series) as well as super cheapies (Silver series). Unfortunately, their QL offering called Booty, a platform game, fails to fall into either category. So, Firebird have chucked in an extra game to justify the price and thereby created an entirely new category (no, not 'Fool's Gold') – 'Super Silver'.

Joviality aside, the entry of a well established software company into the QL market can only bode well, provided, of course, it's not just another Christmas gimmick!



The awe-inspiring Reversi and linear Meteor Storm.

SILHOUETTE

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MICRODRIVE EXCHANGE

Each month, for a trial period, this column will contain details of readers' programs that we are able to offer on microdrive.

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Each program will be a direct copy of the published listing, or an extended version of that listing where the program in question was too long to print in full (programs for which an abridged version has been published are marked with an asterisk).

It must be stressed that we are not selling the software itself, nor providing any guarantee that it performs any particular function (though we do check every program that is to appear in *QL User*), we are merely offering a service to readers who wish to obtain *QL User* programs on drive rather than by typing them in straight from the page.

HOW TO ORDER

Listed below are programs which have appeared as listings inside *QL User*.

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A Didcock	(B)	Connect4	£1.00	Sept	15 ☐
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Williams & Holliday	(AO)	Paladin	£5.00	Apr	70 ☐
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B = SuperBasic, AO = Assembler + Object Code (ready to run), MB = Machine Code + Basic loader

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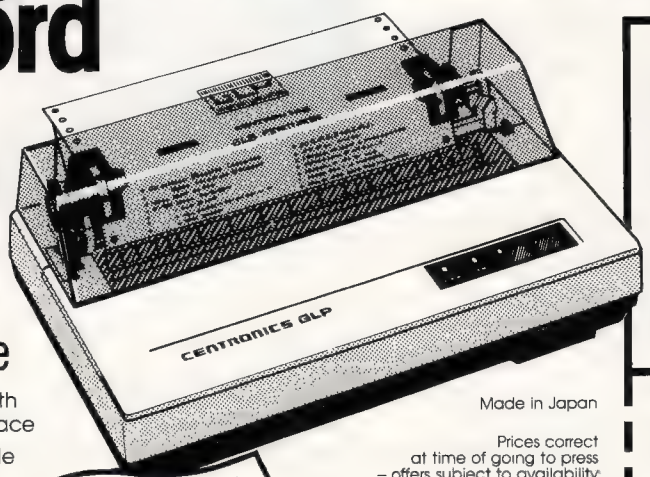

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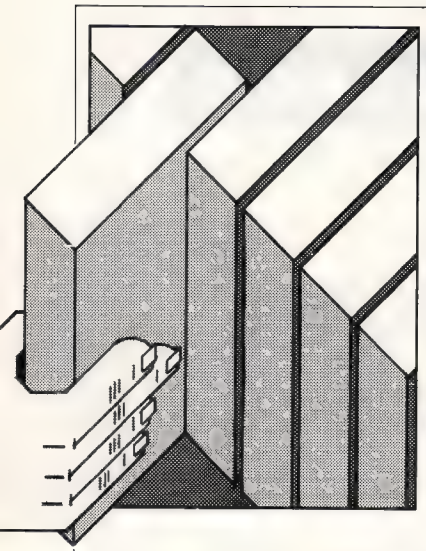

Five more books from the QL collection, reviewed by Nicky Trevett.

Among the new books for QL users this month are two that would fit into your pocket.

The *Sinclair QL* by Guy Langdon and David Heckingbottom, price £3.95, is one in the Pitman series of Computer Handbooks, designed to provide handy references to microcomputers.

This one attempts to cover all the main features of the QL, including a brief specification, entering and running programs, colour and graphics, the real-time clock, sound, mathematical functions, machine code programming, devices and file transfer, the RS232 ports, and so on.

It's certainly not a manual, more an extensive glossary of terms for quick reference, and it's not suitable for the complete beginner. There's no attempt to explain programming terminology when discussing SuperBasic, for example, or basic computer concepts like pixels, and some aspects of the QL are taken for granted – there's no section specifically devoted to QDOS, for instance.

The handbook is organized into logical sections, with useful glossaries of keywords where appropriate (for general SuperBasic programming, graphics, the clock, sound, input/output instructions, mathematical functions, machine-code interface, graphics, and devices and file transfer). The appendices at the back include the ASCII table, character code to key depression conversion table, and a listing of SuperBasic keyword syntax. There is also an index.

In a book of this size, you aren't going to find detailed explanation and example in any of the areas covered, but as a memory jogger or a pocket reference, you might find a use for it.

Archive On The Cheap

The second pocket-sized offering this month is another book about Archive, published by Bernard Babani. *Into the QL Archive* boasts an uninspiring front cover and cramped, hard-to-read text on cheap paper. That would not matter particularly if the book had anything new to say, but I can't see that it has.

It sets out, like most books on Archive, to enable the user to derive the maximum benefit from the program. Specifically, it is aimed at newcomers, possibly to computing and certainly to Archive – this is not a book for experienced users.

As an introduction to Archive, it is clearly written and quite well explained. After answering the question "What is a database?", it looks at creating files, programming, screen layouts, using multiple files, using printers and error handling, with an appendix at the back looking at version 2 differences and how the new version affects the text in the rest of the book. The appendix is mysteriously labelled appendix (i); I couldn't find an appendix (ii).

It is practically orientated towards real-life applications, like setting up a customer file, and there are plenty of listings provided. But it's all a little dry and colourless, and I can't help feeling it's been done better elsewhere.

Still, at least it has the distinction of being extremely cheap if you're on a tight budget (£2.50), and no one can deny that it's probably the smallest book about Archive.

Lively Lothario

For an exercise in lively writing, one has only to turn to Adam Denning's *Advanced Machine Code*, published by Duckworth.

Few would describe machine code programming as a light-hearted subject, but Mr Denning almost manages to make it appear so. The book is very readable, but it is not for the absolute beginner – it's assumed, for example, that the reader has already 'read a book or two' on the subject of the 68000 processor. The book does, however, take trouble to introduce those familiar with processing technology in general to the QL and 68000 assembly technology.

First, there is a brief look at the 68000 chip (or the 68K, as it's referred to here), including its architecture, and its various modes and instructions. The next chapter presents some short machine code programs, including a useful one that defines windows and enters hex machine code into the correct places. The author suggests you save this and use it as a boot file.

Next there is an introduction to QDOS, followed by a chapter which explains how machine code functions and procedures can be incorporated into SuperBasic. Later sections of the book concentrate on file handling (including a look at the 'pipe' device – remember the pipe?), user-defined graphics (giving the lie to those who thought the QL didn't have any), multi-tasking, job control, and screen-handling and graphics.

The last chapter touches wistfully on some aspects of

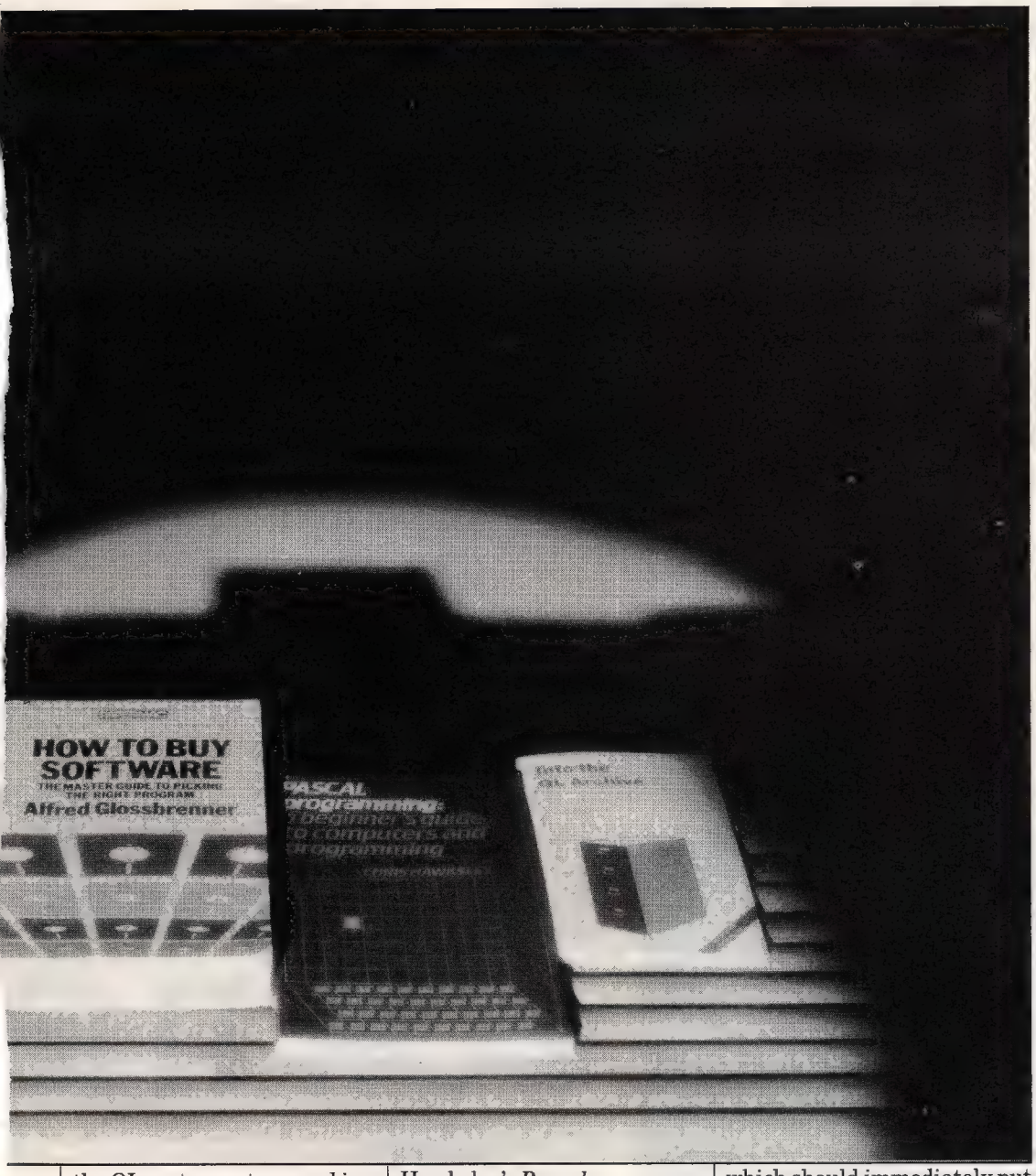

PHOTO BY TERRY BEDDIS

the QL system not covered in the scope of the book, tossing in a few extra QDOS routines.

There are extensive appendices, including an assembler header file (covering trap codes, vectors, offsets and equates used in the book), a listing of some games routines, a SuperBasic utilities listing, and the QDOS system variables. An index is also included.

Basic Pascal

If you've exhausted the possibilities of SuperBasic, how about trying your hand at Pascal?

Published by the Cambridge University Press, Chris Hawksley's *Pascal Programming: A Beginner's Guide to Computer's and Programming* is not so much a guide to Pascal as a guide to programming using Pascal as the example. It's academically-orientated, as might be expected, aimed at programmers 'of all disciplines, including the arts and social sciences', as well as at those with a mathematical or engineering background. But the text adopts an applications-based approach and should prove of use to the new owner of a microcomputer who wants to learn Pascal as well as the student.

The author's introduction is refreshingly down to earth, which should immediately put the nervous novice at ease. He compares learning how to program with the process of learning how to play a musical instrument, for example, and makes it ruthlessly clear that the computer is nothing more nor less than a tool constructed by man, which doesn't make mistakes any more than a carpenter's chisel or a writer's pen.

This promising start is sustained throughout the book, which is entertaining and readable and gives jargon very short shrift. It deliberately moves away from the number-orientated approach of too many academic programming text books, although it retains the 'feel' of a text book – there are exercises at the end of each chapter, for example, which act as a revision aid.

Most, but not all, of the Pascal language is covered, with each feature introduced as it fits naturally into the course of the text. There is a useful set of diagrams at the back illustrating the complete Pascal syntax, plus two very short appendices listing reserved words and standard functions.

I particularly liked the occasional words of wisdom from Blaise Pascal, like "Man is only a reed, the weakest thing in nature; but he is a thinking reed". Now there's a good one next time you want to impress them down at the local.

And Finally . . .

And finally, a monster paperback from Papermac, *How to Buy Software* by Alfred Glossbrenner priced at £9.95, all about choosing the right software package. One look at this, and you're quite likely to think 'cripes, if it takes a book that big to explain how to choose a package, perhaps I won't bother after all'. It must also be said that it's not strictly relevant to the QL. But given that there's a growing library of third-party software becoming available for the QL, you might unearth in the course of this epic a few useful tips on how to set about picking the right program.

It would take another double page spread to list all the areas it covers, so I'll just outline a few of the major topics: How to Read Software Ads and Reviews; The Media and the Message; How to Locate Programs and Software Review; Documentation and Demonstration; Where to Buy Software; the Twelve Sure-Fire Rules for Software Success; Free Software; and much, much more.

A lot of it is mere commonsense, some of it is obvious, and what's more of a problem, a lot of it is very American – American magazines, American prices and so on. But it's all good fun, and in parts, fascinating and laudibly informative.

INSTANT ACCESS

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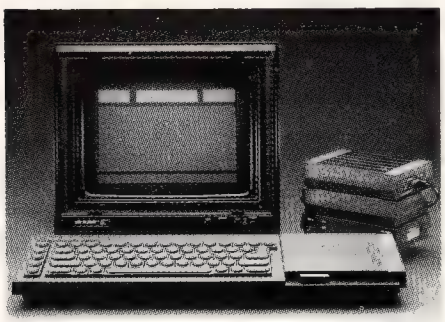

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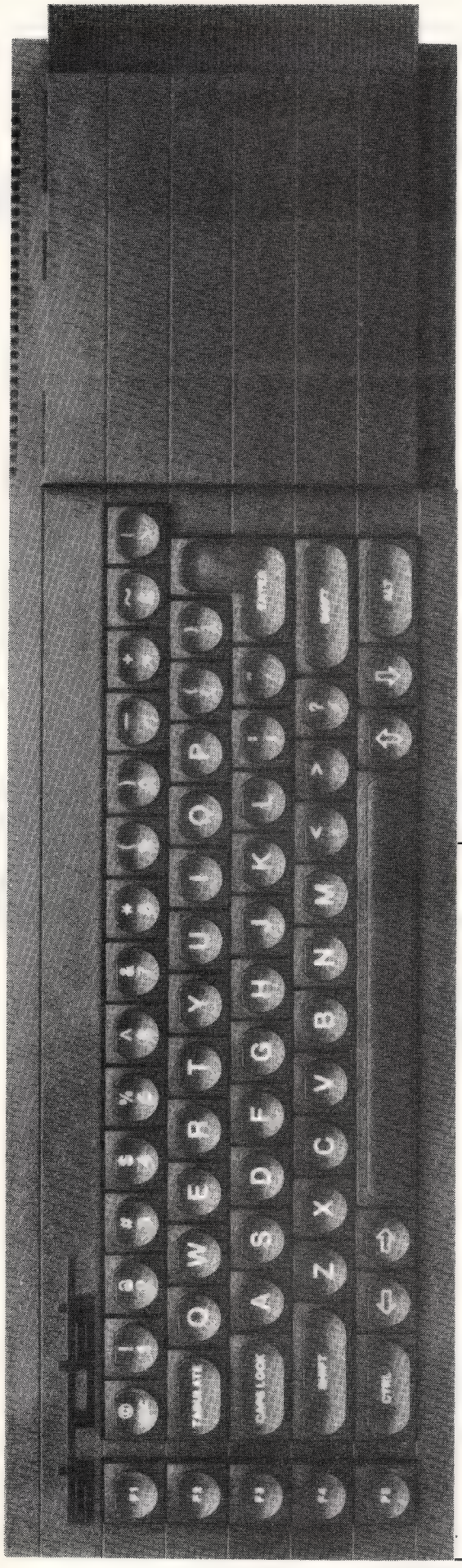

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AI ON THE QL

Categorising words by type is the first step towards extracting their meaning – Mike James shows how this may be done.

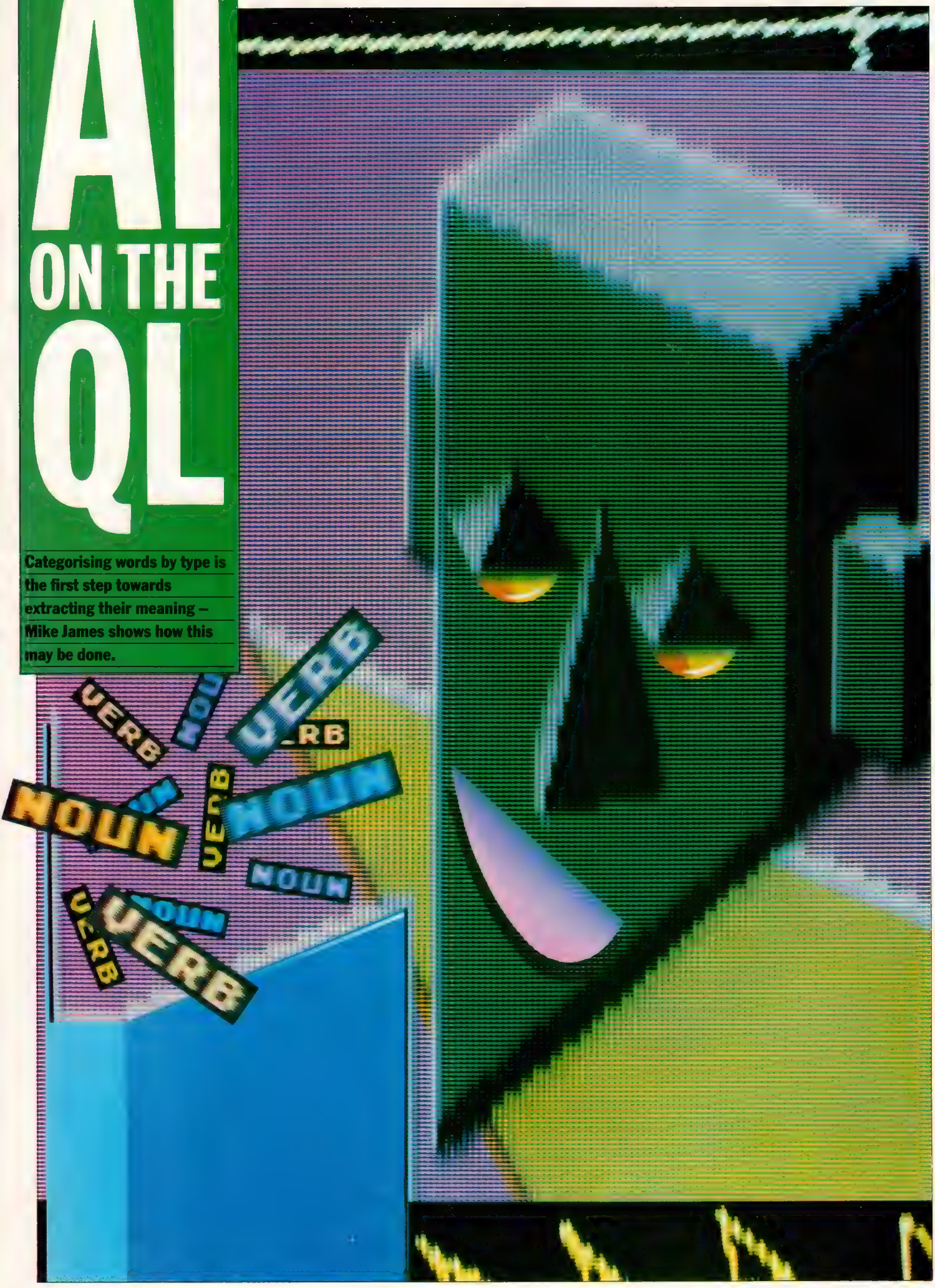

ILLUSTRATION BY PAUL ALLEN

AI ON THE QL

In the previous article on language we looked at the structure or *syntax* of English and how it might be used to generate correct sentences. In this article we look at one method of analysing the structure of a sentence as the first step towards extracting its *meaning*. To produce a program that will analyse, or *parse*, any reasonable English sentence is well beyond the scope of SuperBasic but it is possible to write a program that will analyse a restricted set of English sentences. The *chat* program given last month is ideal for our purposes.

Given a simple construction such as *article noun verb* it is easy to check that a sentence is correct simply by superimposing it as if it were a template. For example "THE PROGRAM RUNS" has the correct form because each word is of the appropriate type (*Fig 1*).

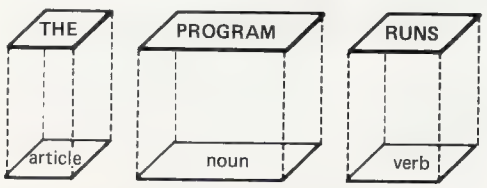

Fig 1. An inflexible rule cannot cope with different constructions.

Whereas "THE BIG PROGRAM RUNS" doesn't fit because BIG isn't a noun.

In a very restricted language you can discover the form of a sentence by trying to match it with a number of possible templates. However, even the simple grammar given last month (changed to template form in *Fig 2*) would need an infinite set of templates to recognise all of the sentence types that it can generate. The reason for this is the presence of <PP> (prepositional phrase) at levels 3, 4, 5, etc. This gives rise to an infinite group of sentences ending in expressions such as "on the road on the bridge over the river by the mountain . . ." and so on.

The solution to this problem is to use a sort of dynamic template against which to match sentences. The most common method in use is the *transition network*. A transition network consists of a number of *states* or *nodes* connected by a number of *arcs*. Each arc is labelled by a grammatical type such as a noun or a <verb phrase>. To recognise the structure of a sentence you have to move through the transition network from beginning to end, taking arcs with labels that correspond to the grammatical type of the part of the sentence that you are currently examining. This is much easier to understand via an example. Level 1 in the grammar given above gives rise to the transition network in *Fig 3*. This means that in

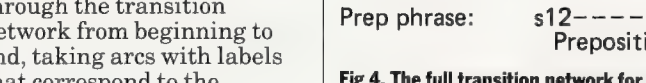

Fig 3. Transition network of level 1 template grammar.

recognising a sentence we need to go through three states. We move from state s1 to state s2 when we recognise a noun phrase, and from state s2 to state s3 when we recognise a verb phrase. Of course, both noun phrase and verb phrase need a transition network of their own and this gives rise to the idea of a *recursive network* in which each arc can itself be a reference to another transition network and moving along an arc can correspond to moving through a number of sub-transition networks at lower levels.

The complete recursive transition network for the four levels is shown in *Fig 4*. Note

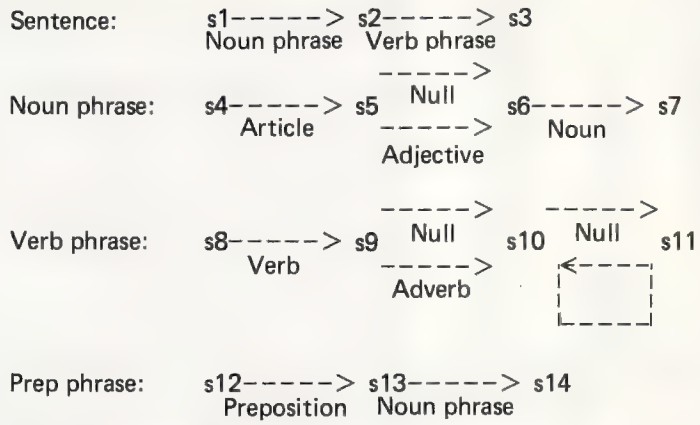

Fig 4. The full transition network for figure two.

the way that the choice between different possibilities is dealt with by a number of different arcs between a pair of states. Also the way that the possibly infinite repetition of prepositional phrases is dealt with by an arc that loops back to the same state (**s10**).

As an example of using the transition network to analyse a sentence, consider

THE BIG PROGRAM RUNS ON THE TINY COMPUTER

Starting from s1 the first arc is labelled "noun phrase" and so to get from s1 to s2 we have to first traverse the noun phrase network. The first word of the sentence is an article so we move from s4 to s5, the next word is an adjective so we move from s5 to s6 along the "adjective" arc and finally PROGRAM is a noun and so we move to s7, so completing the network.

Completing the noun phrase network brings us to node s2 in the sentence network and the process continues with the "verb phrase" network in an effort to move to node s3. In this case the sentence is of a form that can be generated by the grammar rules 1 to 4 given above and so the transition from node 1 to node 3 is achieved.

If the sentence couldn't be generated by the four rules there would be a node within one of the networks that it was impossible to leave because none of the arcs leaving it corresponded to the part of the sentence currently being analysed. In this case the analysis would fail and the sentence would be rejected.

Just moving from one end of a transition network to the other simply tells you that a sentence can be generated by the rules of grammar that the network represents and this is not, in itself, very useful. The important point about a transition network is that the route that you follow through the network give you the structure of the sentence. To be more exact the path through the transition network can be used to generate a *syntax*, or *parse*, *tree*. A parse tree is a diagram that shows the internal structure of a sentence. Once again this is an idea that is easier to understand by way of an example. The parse tree of the simple sentence THE PROGRAM RUNS is shown in *Fig 5*. You should he able to

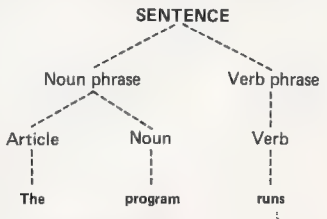

Fig 5. Parse tree for "THE PROGRAM RUNS".

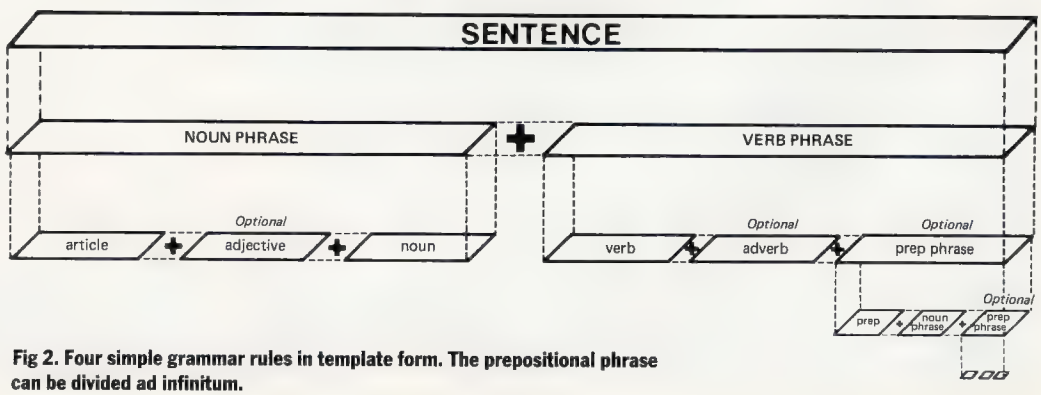

Fig 2. Four simple grammar rules in template form. The prepositional phrase can be divided ad infinitum.

see how the parse tree captures the essential detail of how the different parts of the grammar build up a sentence hierarchically. The aim of most language analysis programs is to build up a parse tree.

Armed with the ideas of recursive transition networks and parse trees it is easy to write a program that will analyse any sentence that can be generated using the four rules of grammar given earlier. The key to turning a recursive transition network into an equivalent program is to notice that each path through the network can be thought of as a path through a program and the labels on each arc can be implemented as procedures that check for the appropriate syntax. For example the transition network for a sentence is equivalent to

```
DEF PROcedure sentence
noun_phrase
verb_phrase
END DEFine sentence
```

where *noun_phrase* and *verb_phrase* are procedures that are equivalent to the noun phrase and verb phrase transition networks. All that is left is to use a variable to flag whether or not a procedure has failed to find the type of syntax that it is looking for and devize a method of printing the parse tree as it is generated.

In most syntax analysis programs the parse tree would be stored for further analysis but this would add too many lines of code to a demonstration program so in this case we just print it out. The method used is based on the fact that each time a procedure is called to analyse a section of the sentence this corresponds to a level one lower in the parse tree and the horizontal position of an item in the tree is related to the current position in the sentence. In the program given below each procedure adds one to the variable *l* when it is entered and subtracts one when it is finished thus *l* gives the current level of the tree that we are working on. Each procedure then prints an appropriate message, e.g. the noun phrase procedure prints "noun phrase" and so on, at line *l*2* and column *(p−1)*10* where *p* is the number of the word currently being analysed. This simple method produces a reasonably tidy parse tree for very little work!

The final program is written as a collection of procedures which are described in Table One. The most interesting features are the way that an infinite sequence of prepositional phrases is dealt with by the REPeat loop in *verb_phrase* and the way that optional items such as adverbs are catered for by not testing the state of the variable *fail*. Notice that you must type sentences in upper case letters only and the program will give correct parse trees only for sentences that can be generated using rules 1 to 4 given above. If a sentence could not have been generated using rules 1 to 4 then the program prints a parse tree up to the point that the analysis fails and then prints the word "fail" in the bottom left hand corner of the screen. Some sentences that the program will parse completely are –

THE COMPUTER RUNS

THE BIG PROGRAM RUNS ON THE TINY COMPUTER

THE POOR PROGRAM DEBUGS SLOWLY ON THE COMPUTER

The transition network parser is useful for analysing very regular and very simple forms of language. One use is in the translation of computer languages. For example, the rules for a valid arithmetic expression can be written as a simple grammar (see *Fig 6*) and these three rules can be converted into a transition network and then into an equivalent program. Such programs lie at the heart of every compiler and interpreter – so language analysis is already big business!

Table One

Procedure	*Purpose*
initialise	Set up arrays and dictionary of words and their types. Type 1=article, 2=noun, 3=adjective, 4=verb, 5=adverb, and 6=preposition
sentence	parse sentence
noun_phrase	parse noun phrase
article	check that the current word is an article
adjective	check that the current word is an adjective
noun	check that the current word is a noun
verb_phrase	parse verb phrase
verb	check that the current word is a verb
adverb	check that the current word is an adverb
prepositional_ phrase	parse prepositional phrase
split_words	split the words in the sentence from the string S$ into the array word$ in such a way that word$(i) holds the ith word
classify_words	use w$ and T to find the type of each word in the sentence. The type of word in word$(i) is stored in type(i)
display	print an element of the parse tree in the correct position.

Computer languages are one thing but English, or any natural language, is quite another matter. For example, even the simple idea that words can be categorised according to their type is fraught with difficulties. Is the word "flash" a verb or a noun? It is a noun in "He saw the flash" but it is a verb in "The light will flash". In short, it can be either depending on the structure of the sentence and, of course, it is this structure that we are trying to deduce!

Another problem is that there are often a number of possible parse trees that will fit a sentence. For example does "The old men and women" mean that both the men and the women are old or is it just the men? A good analysis program will generally return all of the possible parse trees for a sentence and the correct one would be selected by subsequently processing on the basis of *meaning*.

Even ignoring these difficulties there are still features of the English language that cannot be analysed using transition networks. For example, it is difficult to take account of plurality using transition networks. Ideally we would like an analysis program to reject noun phrases such as "This cars" but accept "These cars". The solution to this sort of problem is to add some memory to the transition network to produce an *augmented* transition network or ATN. Most analysis programs use the ATN method to parse correctly a fairly wide range of sentences but the final resolution of ambiguity needs meaning to be taken into consideration. Many A1 researchers are now looking at ways of using meaning to guide syntax analysis right from the very start.

1. <EXPRESSION> → <TERM>|[<TERM>+<EXPRESSION>]|[<TERM>−<EXPRESSION>]
2. <TERM> → <FACTOR>|[<FACTOR>*<TERM>]|[<FACTOR>/<TERM>]
3. <FACTOR> → NUMBER|[−<FACTOR>]|<EXPRESSION>

Fig 6. Arithmetic operations as a simple grammar.

LISTING

```
10   REMark SYNTAX
15   MODE 4
20   WINDOW 452,236,60,20
30   initialise
40   REPeat main_loop
50    AT 21,5:INPUT S$
60    split_words
70    classify_words
80    CLS
90    l=0:p=1
100   sentence
110   IF fail THEN AT 22,5:PRINT "failed"
120  END REPeat main_loop
1000 DEFine PROCedure initialise
1005 W=19
1010 DIM W$(W,20),T(W)
1015 DIM word$(20,20),type(20)
1020 DATA "A",1,"THE",1
1030 DATA "COMPUTER",2,"PRINTER",2,"PROGRAM",2
1040 DATA "BUG",2
1050 DATA "BIG",3,"TINY",3,"POOR",3
1060 DATA "WRITES",4,"RUNS",4,"DEBUGS",4
1070 DATA "PRINTS",4
1080 DATA "SLOWLY",5,"FAST",5,"QUICKLY",5
1090 DATA "ON",6,"TO",6,"UNDER",6
1400 RESTORE
1500 FOR I=1 TO W
1510  READ W$(I),T(I)
1520 END FOR I
1600 true=1
```

```
1610 false=0
1999 END DEFine initialise

2000 DEFine PROCedure sentence
2005 l=l+1
2006 display l,p,"sentence"
2010 noun_phrase
2020 IF fail THEN END DEFine sentence
2030 verb_phrase
2040 IF fail THEN END DEFine sentence
2050 fail=false
2060 l=l-1
2070 END DEFine sentence

3000 DEFine PROCedure noun_phrase
3005 l=l+1
3006 display l,p,"noun phrase"
3010 article
3020 IF fail THEN END DEFine noun_phrase
3030 adjective
3040 noun
3050 IF fail THEN END DEFine noun_phrase
3060 fail=false
3066 l=l-1
3070 END DEFine noun_phrase

4000 DEFine PROCedure article
4010 l=l+1
4030 IF type(p)=1 THEN
4035  display l,p,"article"
4040  display l+1,p,word$(p)
4050  p=p+1
4060  fail=false
4070 ELSE
4080   fail=true
4090 END IF
4095 l=l-1
4100 END DEFine article

4500 DEFine PROCedure adjective
4510 l=l+1
4520 IF type(p)=3 THEN
4530  fail=false
4540  display l,p,"adjective"
4550  display l+1,p,word$(p)
4560  p=p+1
4570 ELSE
4580  fail=true
4590 END IF
4595 l=l-1
4600 END DEFine adjective

4700 DEFine PROCedure noun
4710 l=l+1
4720 IF type(p)=2 THEN
4730  fail=false
4740  display l,p,"noun"
4750  display l+1,p,word$(p)
4760  p=p+1
4770 ELSE
4780  fail=true
4790 END IF
4793 l=l-1
4795 END DEFine noun

5000 DEFine PROCedure verb_phrase
5010 l=l+1
5020 display l,p,"verb phrase"
5030 verb
5040 IF fail THEN
5050  END DEFine verb
5060 ELSE
5070  adverb
5080  REPeat pp
5085   IF p>S THEN fail=false:EXIT pp
5090   prepositional_phrase
5100   IF fail THEN EXIT pp
5110  END REPeat pp
5130 END IF
5140 l=l-1
5150 END DEFine verb_phrase

6000 DEFine PROCedure verb
6010 l=l+1
6020 IF type(p)=4 THEN
6030  display l,p,"verb"
6040  display l+1,p,word$(p)
6050  fail=false
6055  p=p+1
6060 ELSE
6070  fail=true
6080 END IF
6090 l=l-1
6100 END DEFine verb

6500 DEFine PROCedure adverb
6510 l=l+1
6520 IF type(p)=5 THEN
6530  display l,p,"adverb"
6540  display l+1,p,word$(p)
6550  fail=false
6560  p=p+1
6570 ELSE
6580  fail=true
6590 END IF
6600 l=l-1
6610 END DEFine adverb

7000 DEFine PROCedure prepositional_phrase
7010 l=l+1
7020 display l,p,"prep. phrase"
7030 preposition
7040 IF fail THEN END DEFine prepositional_phrase
7050 noun_phrase
7055 l=l-1
7060 END DEFine prepositional_phrase

8000 DEFine PROCedure preposition
8010 l=l+1
8020 IF type(p)=6 THEN
8030  display l,p,"prep."
8040  display l+1,p,word$(p)
8050  p=p+1
8060  fail=false
8070 ELSE
8080  fail=true
8090 END IF
8100 l=l-1
8110 END DEFine preposition

9000 DEFine PROCedure split_words
9010 l=1:S=0
9015 FOR I=1 TO 20
9017  word$(I)="":type(I)=0
9019 NEXT I
9020 REPeat words
9030  REPeat first_char
9040   IF l>LEN(S$) THEN EXIT first_char
9045   IF S$(l)=" " THEN
9050    l=l+1
9060   ELSE
9070    EXIT first_char
9075   END IF
9080  END REPeat first_char
9090  IF l>=LEN(S$) THEN EXIT words
9100  S=S+1
9110  word$(S)=S$(l)
9120  l=l+1
9130  REPeat next_blank
9140   IF l>LEN(S$) THEN EXIT next_blank
9145   IF S$(l)=" " THEN
9150    EXIT next_blank
9160   ELSE
9170    word$(S)=word$(S) & S$(l)
9180    l=l+1
9190   END IF
9200  END REPeat next_blank
9210 END REPeat words
9220 END DEFine split_words

9500 DEFine PROCedure classify_words
9510 FOR I=1 TO S
9520  FOR j=1 TO W
9530   IF word$(I)=W$(j) THEN
9540    type(I)=T(j)
9550    EXIT j
9560   ELSE
9570    NEXT j
9580   END IF
9590  END FOR j
9600 END FOR I
9610 END DEFine classify_word

9700 DEFine PROCedure display(l,c,a$)
9710 IF c>6 THEN
9720  AT (l+3)*2,(c-6)*10
9730 ELSE
9740  AT l*2,(c-1)*10
9750 END IF
9760 PRINT a$
9770 END DEFine display
```

Next month – The final part of AI on the QL
Memory and Meaning

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THE P+R⊙G⊖S

Pentathlete

A Didcock

The first half of this program was printed rather small last month, so we decided to reproduce the whole listing this month (if you entered the first half, start from the fine line on p.46).

To play, build up power/speed using the left and right cursor keys – press SPACE to jump and hold it down to set the angle.

```
1 REMark track_boot
3 MODE 8
4 LBYTES mdv1_title_screen,131072
5 MERGE mdv1_UDG_data
6 GO TO 32000
7 MRUN mdv1_TRACK_and_FIELD
10 hiscore=0
20 f_level
40 draw_main_screen
50 draw_power
60 initialise
69 :
90 REPeat game
100  event_1: screen
110  IF NOT qualify THEN end_routine: GO TO 20
120  event_2: screen
130  IF NOT qualify THEN end_routine: GO TO 20
140  event_3: screen
150  IF NOT qualify THEN end_routine: GO TO 20
160  event_4: screen
170  IF NOT qualify THEN end_routine: GO TO 20
180  event_5: screen
190  IF NOT qualify THEN end_routine: GO TO 20
200  next_level
210  IF NOT qualify THEN end_routine: GO TO 20
215  level=level+.5
220 END REPeat game
699 :
700 DEFine PROCedure hi_scores
705 LOCal i
707 hi(event,0)=distance
708 hi$(event,0)=a$
710 IF hi(event,0)>hi(event,1) THEN
720  wr=wr+1
730  FOR i=3 TO 1  STEP -1
740   hi(event,i)=hi(event,i-1)
750   hi$(event,i)=hi$(event,i-1)
760  END FOR i
762  RETurn
764 END IF
766 IF hi(event,0)>hi(event,2) THEN
770  hi(event,3)=hi(event,2):hi$(event,3)=hi$(even
t,2)
772  hi(event,2)=hi(event,0):hi$(event,2)=hi$(even
t,0)
774  wr=wr+1
776  RETurn
778 END IF
780 IF hi(event,0)>hi(event,3) THEN
782  wr=wr+1
784  hi(event,3)=hi(event,0):hi$(event,3)=hi$(even
t,0)
786  RETurn
788 END IF
790 END DEFine
799 :
800 DEFine PROCedure reset
810 STRIP #3,7,0
820 AT #3,1,8:PRINT #3,"                    "
830 INK #3,2: STRIP #3,7
840 AT #3,1,36:PRINT #3,"00 "
850 END DEFine
899 :
900 DEFine PROCedure time (type)
910 SELect ON type
920 ON type=0: ft=DATE: RETurn
930 ON type=1: ut=DATE-ft:ut$=DATE$(ut)
940 END SELect
942 CSIZE 2,0
945 INK 5:STRIP 2:AT 8,35:PRINT ut$(19 TO);".00"
950 END DEFine
999 :
1000 DEFine PROCedure event_1
1005 event=1:CLS #7:draw_shot:reset
1006 pos=2: qual=0
1007 INK #4,7:FOR i=2 TO 4:AT #4,i,14:PRINT #4,"00
.00":END FOR i
1009 REPeat shot
1010 PAPER 0:INK 5
1011 foul=0
1015 CSIZE 2,1
1020 x=8: y=3:power=8
1025 AT x,y:PRINT CHR$(128)
1030 INK 0,7:FILL 1:CIRCLE 12,32,.75:FILL 0
1040 CSIZE 2,0:INK 2:PAPER 4:AT 10,3:PRINT "YOUR G
O:"
1045 FOR i=100 TO 10 STEP -1:BEEP 300,i:END FOR i
1052 BEEP 1000,5
1055 AT 10,3:PRINT "        ": AT #3,1,power:STRIP
 #3,0:PRINT #3," "
1056 n=0
1060 FOR shot_loop=1 TO 60
1070  key1=KEYROW(1)
1072  IF key1<>0 THEN BEEP 200,100
1073  IF key1>=64 AND key1<100 THEN EXIT shot_loop
1075  IF key1<>0 AND key1<>key2 AND power<23.5 THE
N n=n+1
1076  IF n=INT(level) THEN power=power+1:n=0
1080  IF power>8 AND (key1=0 OR key1=key2) THEN po
wer=power-.2
1090  AT #3,1,power:STRIP #3,0:PRINT #3," ":STRIP
#3,7,0:AT #3,1,power+1:PRINT #3," "
1095  FOR i=1 TO 120:END FOR i
1100  key2=key1
1120 END FOR shot_loop
1130 IF shot_loop=60 THEN foul=1
1140 IF NOT foul THEN throw: GO TO 1200
1150 INK 2:STRIP 1:FLASH 1
1160 AT 14,2:PRINT "FOUL":BEEP 0,30,37,9000,7,0,0,
0
1170 FLASH 0
1175 AT #4,pos,14:PRINT #4,"------"
1180 FOR i=1 TO 1000: END FOR i: BEEP
1195 distance=0
1200 pos=pos+1
1210 score=score+INT(distance*10)
1215 INK #4,2
1230 IF score>9 AND score<100 THEN AT #4,0,10:PRIN
T #4,score
1240 IF score>99 AND score<1000 THEN AT #4,0,9:PRI
NT #4,score
1245 IF score>999 AND score<10000 THEN AT #4,0,8:P
RINT #4,score
1246 IF score>9999 THEN AT #4,0,7:PRINT #4,score
1250 IF NOT foul THEN INK 2:FILL 1:CIRCLE x,y,.8:F
ILL 0
1270 draw_shot
1280 reset
1282 INK 4
1283 FOR i=1 TO 1500:END FOR i
1285 AT 11,1:PRINT "                    "
1286 AT 13,1:PRINT "                    "
1288 STRIP 4:AT 14,2:PRINT "    "
1290 hi_scores
1291 print_hi_scores
1292 power=8
1293 IF pos=5 THEN EXIT shot
1295 END REPeat shot
1296 qualify=qual
1297 END DEFine
1299 :
1300 DEFine PROCedure throw
1305 CSIZE 2,1:STRIP 0:INK 5
1310 AT x,y:PRINT " ":AT x,y+1:PRINT CHR$(129)
1320 BEEP 1000,5
1325 angle=10: STRIP #3,7: INK #3,2
1326 AT #3,1,36:PRINT #3,angle
1330 REPeat key
1340 IF KEYROW(1)=0 OR angle>80 THEN EXIT key
1350 angle=angle+2
1360 AT #3,1,36:PRINT #3,angle
1370 END REPeat key
1375 x=22: y=37: INK 0,7
1376 FILL 1:CIRCLE x,y,1: FILL 0
1377 IF angle<50 THEN a=(angle/10.5)
1378 IF angle>49 THEN a=(1/angle)*200
1379 b=angle/40
1380 n=0
1384 i=0
1385 REPeat launch
1386 i=i+1
1390 x1=x: y1=y
1400 IF i>power*.7 AND NOT n THEN a=a-(a/3): b=-(b
*2): n=1
1410 x=x+a: y=y+b
1420 FILL 1:INK 4:CIRCLE x1,y1,1:FILL 0
1430 FILL 1:INK 0,7:CIRCLE x,y,1:FILL 0
1440 IF y<=30 THEN EXIT launch
1450 END REPeat launch
1460 draw_shot
1470 FILL 1:INK 0,7:CIRCLE x,y,1:FILL 0
1475 di=11
1480 FOR i=26 TO x
1490  di=di+1
1510 END FOR i
1520 distance=((di/35)*7)+(INT(RND(0 TO 20))/100)
1530 CSIZE 2,0:INK 2
1540 AT 11,1:PRINT "YOUR THROW WAS ";distance;"m"
1550 IF distance>=15.28 AND NOT qual THEN INK 0: A
T 13,1:PRINT "YOU HAVE QUALIFIED":qual=1
1560 IF distance>=10 THEN AT #4,pos,14:PRINT #4,di
stance: ELSE AT #4,pos,15:PRINT #4,distance
1570 END DEFine
1999 :
2000 DEFine PROCedure event_2
2005 event=2
2010 pos=2:level2=1:lim=.2
2015 CLS #7
2020 INK #4,7:FOR i=2 TO 4:AT #4,i,14:PRINT #4,"00
.00":END FOR i
2021 IF INT(level)=3 THEN level2=2
2022 IF INT(level)=2 THEN lim=1
2025 qual=0
2027 REPeat sprint_loop
2030 draw_sprint
2035 time (0):time (1):INK 0:AT 8,30:PRINT "TIME:"
2040 foul=0: tot=1: go=1: fin=290: power=8
2045 reset
2050 CSIZE 2,1:INK 5:STRIP 2:AT 8,14:PRINT CHR$(13
0)
2055 co=14
2060 n=0: key1=0: key2=0: char=130: total=380
2065 CSIZE 2,0:INK 2:PAPER 4:AT 10,3:PRINT "GET RE
ADY . . ."
2070 le=RND(900 TO 1400)
2075 FOR i=1 TO le:END FOR i
2080 BEEP 1000,1:AT 12,3:PRINT "GO!"
2083 time (0)
2085 PAUSE 40000
2086 AT #3,1,power:STRIP #3,0:PRINT #3," "
2090 AT 10,3:PRINT "                ":AT 12,3:PRIN
T "    "
2100 REPeat sprint_1
2105  IF char=131 THEN time (1)
2110  CSIZE 2,1:STRIP 2:INK 5
2120  key1=KEYROW(1)
2125  BEEP 300,100
2130  IF key1<>0 AND key1<>key2 AND power<23.5 THE
N n=n+1
```

```
2135  IF n=level2 THEN power=power+1:n=0
2140  IF power>8 AND (key1=0 OR key1=key2) THEN po
wer=power-lim
2145  AT #3,1,power:STRIP #3,0:PRINT #3," ":STRIP
#3,7,0:AT #3,1,power+1:PRINT #3," "
2150  key2=key1
2155  total=total-power
2160  IF char=130 THEN char=131: ELSE char=130
2162  IF co>=30 THEN co=0:INK #6,7:POINT #6,732,0:
 POINT #6,732,100
2165  IF NOT gm THEN AT 8,14:PRINT " ":PAN #6,-pow
er:AT 8,14:PRINT CHR$(char)
2170  IF gm THEN AT 8,14:PRINT " ":PAN #6,-25:AT 8
,14:PRINT CHR$(char)
2175  co=co+power
2180  IF total<100 AND tot THEN LINE #6,730,100 TO
 680,0: tot=0
2182  IF total<100 THEN fin=fin-power
2183  IF fin<=0 THEN EXIT sprint_l
2185  gm=0
2190 END REPeat sprint_l
2195 tme=ut$(19 TO )+(INT(RND(1 TO 98))/100)
2200 CSIZE 2,0:STRIP 2:INK 5
2205 IF tme<10 THEN AT 8,35:PRINT "0";tme: ELSE AT
 8,35:PRINT tme
2210 BEEP 1000,1
2215 IF tme<10 THEN AT #4,pos,14:PRINT #4,"0";tme:
 ELSE AT #4,pos,14:PRINT #4,tme
2220 pos=pos+1
2225 IF NOT qual AND tme<12.65 THEN qual=1:INK 0:S
TRIP 4:AT 13,1:PRINT "YOU HAVE QUALIFIED"
2230 score=score+INT((30-tme)*15)
2232 INK #4,2
2235 IF score>9 AND score<100 THEN AT #4,0,10:PRIN
T #4,score
2240 IF score>99 AND score<1000THEN AT #4,0,9:PRIN
T #4,score
2245 IF score>999 AND score<10000 THEN AT #4,0,8:P
RINT #4,score
2246 IF score>9999 THEN AT #4,0,7:PRINT #4,score
2250 hi_scores_2
2255 print_hi_scores
2260 FOR i=1 TO 1500: END FOR i
2265 AT 13,1:STRIP 4:PRINT "                    "
2270 IF pos=5 THEN EXIT sprint_loop
2275 END REPeat sprint_loop
2280 qualify=qual
2285 END DEFine
2999 :
3000 DEFine PROCedure event_3
3005 event=3:pos=2:CLS #7
3010 INK #4,7:FOR i=2 TO 4:AT #4,i,14:PRINT #4,"00
.00":END FOR i
3015 qual=0
3020 REPeat jav_loop
3025 draw_jav
3030 foul=0:power=8:reset:dist=0:me=0
3035 key1=0:key2=0:char=132:n=0:co=0
3040 CSIZE 2,1:STRIP 2:INK 5:AT 9,8:PRINT CHR$(132
)
3045 INK 7:LINE 25,26 TO 35,26
3050 CSIZE 2,0:INK 2:PAPER 4:AT 10,3:PRINT "YOUR G
O:"
3055 FOR i=100 TO 10 STEP -1:BEEP 300,i:END FOR i
3056 PAUSE 40000
3060 BEEP 1000,5
3065 AT 10,3:PRINT "          ":AT #3,1,power:STRIP
 #3,0:PRINT #3," "
3067 CSIZE 2,1
3070 FOR i=1 TO 34
3075  key1=KEYROW(1)
3080  BEEP 300,100
3083  IF key1>=64 AND key1<100 THEN EXIT i
3085  IF key1<>0 AND key1<>key2 AND power<23.5 THE
N n=n+1
3090  IF n=INT(level) THEN power=power+1:n=0
3095  IF power>8 AND (key1=0 OR key1=key2) THEN po
wer=power-.2
3100  AT #3,1,power:STRIP #3,0:PRINT #3," ":STRIP
#3,7,0:AT #3,1,power+1:PRINT #3," "
3105  key2=key1
3110  IF char=133 THEN char=132: ELSE char=133
3115  INK 2:STRIP 2
3120  LINE 25,26 TO 35,26:AT 9,8:PRINT " ":PAN #8,
-10:INK 5:AT 9,8:PRINT CHR$(char):INK 7:LINE 25,26
 TO 35,26
3124  co=co+1
3125  IF co=10 THEN INK 2:CSIZE 2,0:STRIP 1:AT 19,
37:PRINT me+10
3126  IF co=10 THEN LINE #8,1451,100 TO 1371,0:co=
0:me=me+10
3127  CSIZE 2,1:INK 5:STRIP 2
3180 END FOR i
3185 IF i=34 THEN foul=1
3186 dist=-((33-i)):power=power*1.14
3190 IF NOT foul THEN throw_jav:GO TO 3200
3191 CSIZE 2,0
3192 distance=0
3193 STRIP 1:INK 2:FLASH 1:AT 14,2:PRINT "FOUL":BE
EP 0,30,37,9000,7,0,0,0:FLASH 0
3194 FOR i=1 TO 1000:END FOR i:BEEP
3195 INK #4,7:AT #4,pos,14:PRINT #4,"-----"
3200 pos=pos+1
3205 INK #4,2
3210 IF score>9 AND score<100 THEN AT #4,0,10:PRIN
T #4,score
3215 IF score>99 AND score<1000 THEN AT #4,0,9:PRI
NT #4,score
3220 IF score>999 AND score<10000 THEN AT #4,0,8:P
RINT #4,score
3221 IF score>9999 THEN AT #4,0,7:PRINT #4,score
3225 hi_scores
3230 print_hi_scores
3235 FOR i=1 TO 1500:END FOR i
3236 STRIP 4
3240 AT 11,1:PRINT "                    ":AT 13,1:
PRINT "                "
3241 AT 14,2:PRINT "     "
3245 IF pos=5 THEN EXIT jav_loop
3250 END REPeat jav_loop
3255 qualify=qual
3260 END DEFine
3299 :
3300 DEFine PROCedure throw_jav
3305 BEEP 1000,5
3310 angle=10:STRIP #3,7:INK #3,2
3315 AT #3,1,36:PRINT #3,angle
3320 REPeat key_jav
3325  IF KEYROW(1)=0 OR angle>80 THEN EXIT key_jav
3330  angle=angle+3
3335  AT #3,1,36:PRINT #3,angle
3340 END REPeat key_jav
3342 BEEP 1000,5
3345 x=25:y=28
3350 h=angle/60: a=angle/12:b=SQRT(100-(a*a)):hh=1
:a1=a:ha=0
3355 INK 2:LINE 25,26 TO 35,26:INK 7:LINE x,y TO x
+b,y+a
3356 IF angle>50 THEN power=power-(angle/10)
3357 i=1
3358 IF angle<30 THEN power=power-1
3360 REPeat mve_jav
3362 y1=y
3370 PAN #8,-10
3373 co=co+1: dist=dist+1
3374 IF co=10 AND me<90 THEN INK 2:CSIZE 2,0:STRIP
 1:AT 19,37:PRINT me+10
3375 IF co=10 THEN LINE #8,1451,100 TO 1371,0:co=0
:me=me+10
3380 IF (y+h)+a<64 AND NOT ha THEN y=y+h
3384 IF y+a<28 THEN EXIT mve_jav
3385 INK 4:LINE x,y1 TO x+b,y1+a1:INK 7:LINE x,y T
O x+b,y+a
3386 a1=a
3390 IF i>(power*3)*.7 AND hh THEN hh=0:h=-h:a=-a:
ha=0
3396 IF i>(power*3)*.5 AND hh THEN ha=1
3397 i=i+1
3399 END REPeat mve_jav
3402 PAN #8,-29
3405 INK 4:LINE x,y1 TO x+b,y1+a1:INK 7:LINE x,y+a
 TO x+b,y+(a+a)
3410 CSIZE 2,1:INK 2:STRIP 4
3412 distance=dist+(INT(RND(1 TO 98))/100)
3413 CSIZE 2,0
3414 IF distance<1 THEN distance=0:dist=distance
3415 AT 11,1:PRINT "YOU THROW WAS ";distance;"m"
3420 IF distance>70.23 AND NOT qual THEN INK 0:AT
13,1:PRINT "YOU HAVE QUALIFIED":qual=1
3425 score=score+(dist*3)
3430 IF distance<10 THEN INK #4,7:AT #4,pos,14:PRI
NT #4,"0";distance: ELSE INK #4,7:AT #4,pos,14:PRI
NT #4,distance
3440 END DEFine
3999 :
4000 DEFine PROCedure event_4
4005 event=4:pos=2:CLS #7:qual=0
4010 INK #4,7:FOR i=2 TO 4:AT #4,i,14:PRINT #4,"00
.00":END FOR i
4015 REPeat lo_sprint_loop
4020 draw_lsprint
4025 time (0):time (1):INK 0:AT 8,30:PRINT "TIME:"
4030 foul=0:tot=1:gm=1:fin=290:power=8:limit=23.5
4035 reset
4040 CSIZE 2,1:INK 5:STRIP 2:AT 8,14:PRINT CHR$(13
0)
4045 co=14:n=0:key1=0:key2=0:char=130:total=740:po
w_to=0
4050 CSIZE 2,0:INK 2:PAPER 4:AT 10,3:PRINT "GET RE
ADY . . ."
4055 le=RND(1000 TO 1600)
4060 FOR i=1 TO le:END FOR i
4065 BEEP 1000,1:AT 12,3:PRINT "GO!"
4070 time (0)
4075 PAUSE 40000
4080 AT #3,1,power:STRIP #3,0:PRINT #3," "
4085 AT 10,3:PRINT "                ":AT 12,3:PRIN
T "    "
4090 REPeat lo_sprint_l
4095  IF char=130 THEN time (1)
4100  CSIZE 2,1:STRIP 2:INK 5
4105  key1=KEYROW(1)
4110  BEEP 300,100
4115  IF key1<>0 AND key1<>key2 AND power<limit TH
EN n=n+1
4117  IF power<limit AND n=INT(level) THEN power=p
ower+1
4120  IF n=INT(level) THEN n=0:pow_to=pow_to+power
4122  IF power>=limit AND power>8 THEN power=power
-1
4125  IF power>8 AND (key1=0 OR key1=key2) AND pow
er<limit  THEN power=power-.1666667
4130  AT #3,1,power:STRIP #3,0:PRINT #3," ":STRIP
#3,7,0:AT #3,1,power+1:PRINT #3," "
4135  key2=key1:IF total>25 THEN total=total-(powe
r*.95)
4140  IF char=130 THEN char=131: ELSE char=130
4143  IF pow_to>240 AND limit>10 THEN limit=INT(li
mit-(total/40)):pow_to=0
4145  IF co>=30 THEN co=0:INK #6,7:POINT #6,732,0:
 POINT #6,732,100
4146  CSIZE 2,1:STRIP 2:INK 5
4150  IF NOT gm THEN AT 8,14:PRINT " ":PAN #6,-pow
er:AT 8,14:PRINT CHR$(char)
4155  IF gm THEN AT 8,14:PRINT " ":PAN #6,-25:AT 8
,14:PRINT CHR$(char)
4160  co=co+power
4165  IF total<100 AND tot THEN LINE #6,730,100 TO
 680,0: tot=0
4170  IF total<100 THEN fin=fin-power
4175  IF fin<=0 THEN EXIT lo_sprint_l
4180  gm=0
4185 END REPeat lo_sprint_l
4195 tme=ut$(19 TO )+(INT(RND(1 TO 98))/100)
```

```
4200 CSIZE 2,0:STRIP 2:INK 5
4205 AT 8,35:PRINT tme
4210 BEEP 1000,1
4215 AT #4,pos,14:PRINT #4,tme
4220 pos=pos+1
4225 IF NOT qual AND tme<21.54 THEN qual=1:INK 0:S
TRIP 4:AT 13,1:PRINT "YOU HAVE QUALIFIED"
4230 score=score+INT((40-tme)*15)
4232 INK #4,2
4235 IF score>9 AND score<100 THEN AT #4,0,10:PRIN
T #4,score
4240 IF score>99 AND score<1000 THEN AT #4,0,9:PRI
NT #4,score
4245 IF score>999 AND score<10000 THEN AT #4,0,8:P
RINT #4,score
4246 IF score>9999 THEN AT #4,0,7:PRINT #4,score
4250 hi_scores_2
4255 print_hi_scores
4260 FOR i=1 TO 1500:END FOR i
4265 AT 13,1:STRIP 4:PRINT "                    "
4270 IF pos=5 THEN EXIT lo_sprint_loop
4275 END REPeat lo_sprint_loop
4280 qualify=qual
4285 END DEFine
4999 :
5000 DEFine PROCedure event_5
5005 event=5:pos=2:qual=0:lim=.2
5010 INK #4,7:FOR i=2 TO 4:AT #4,i,14:PRINT #4,"00
.00":END FOR i
5011 IF INT(level)=2 THEN lim=.5
5012 IF INT(level)=3 THEN lim=1
5015 REPeat long_jump
5020 draw_jump
5025 foul=0: power=8: n=0:key1=0:key2=0:char=130:x
=7:y=2
5030 reset
5035 PAPER 2:INK 1:CSIZE 2,1:AT 7,2:PRINT CHR$(130
)
5040 CSIZE 2,0:INK 2:PAPER 4:AT 10,3:PRINT "YOUR G
O:"
5045 FOR i=100 TO 10 STEP -1:BEEP 300,i:END FOR i
5046 PAUSE 40000
5050 BEEP 1000,5
5055 AT 10,3:PRINT "        ": AT #3,1,power:STRIP
 #3,0:PRINT #3," "
5056 CSIZE 2,1:PAPER 2:INK 1
```

```
5060 REPeat jump_1
5065  key1=KEYROW(1)
5070  BEEP 300,100
5075  IF key1<>0 AND key1<>key2 AND power<23.5 THE
N n=n+1
5080  IF n=1 THEN power=power+1:n=0
5085  IF power>8 AND (key1=0 OR key1=key2) THEN po
wer=power-1im
5086  IF key1>=64 AND key1<100  THEN EXIT jump_1
5090  AT #3,1,power:STRIP #3,0:PRINT #3," ":STRIP
#3,7,0:AT #3,1,power+1:PRINT #3," "
5095  key2=key1
5100  y=y+1
5105  IF char=130 THEN char=131: ELSE char=130
5110  AT x,y-1:PRINT " ":AT x,y:PRINT CHR$(char)
5125  IF key1=64 THEN EXIT jump_1
5130  FOR i=1 TO 90:END FOR i
5135  IF y>=31 THEN foul=1: EXIT jump_1
5150 END REPeat jump_1
5152 IF y>=31 THEN foul=1
5155 IF NOT foul THEN leap: GO TO 5200
5160 INK 2:STRIP 1:FLASH 1:CSIZE 2,0
5165 AT 14,2:PRINT "FOUL":BEEP 0,30,37,9000,7,0,0,
0
5170 FLASH 0
5175 AT #4,pos,14:PRINT #4,"-----"
5180 FOR i=1 TO 1000: END FOR i: BEEP
5185 distance=0
5200 pos=pos+1
5205 hi_scores
5210 print_hi_scores
5215 FOR i=1 TO 2000:END FOR i
5220 IF pos=5 THEN EXIT long_jump
5225 END REPeat long_jump
5230 qualify=qual
5240 END DEFine
5299 :
5300 DEFine PROCedure leap
5310 angle=10:STRIP #3,7:INK #3,2
5315 AT #3,1,36:PRINT #3,angle
5320 REPeat angle_jump
5325  IF KEYROW(1)=0 OR angle>80 THEN EXIT angle_j
ump
5330  angle=angle+3
5335  AT #3,1,36:PRINT #3,angle
5340 END REPeat angle_jump
5345 BEEP 300,5
5346 IF angle>=50 THEN decr=(4.2/angle)*10: ELSE d
ecr=(angle/55)
5350 dist=(power*4)*decr
5352 distance=-((30-y)*.5)
5355 INK 1
5356 ne=4
5360 AT x,y:PRINT " ":PAN #8,-10:STRIP ne:AT x-1,y
:PRINT CHR$(134)
5365 x=x-1
5366 FOR i=1 TO 150 :END FOR i
5370 AT x,y:PRINT " ":PAN #8,-10:STRIP ne:AT x-1,y
:PRINT CHR$(134)
5375 x=x-1
5376 INK #8,2
5380 FOR i=1 TO (dist/5)
5385  FOR j=1 TO 60:END FOR j
5390  PAN #8,-10
5395  distance=distance+.5
5400 END FOR i
5410 IF distance>=1 THEN ne=6: ELSE  ne=2
5420 AT x,y:PRINT " ":PAN #8,-15:CSIZE 2,0:AT (x*2
)+1,y:CSIZE 2,1:PRINT CHR$(134)
5430 FOR i=1 TO 150:END FOR i
5435 CSIZE 2,0:AT (x*2)+1,y:CSIZE 2,1:PRINT " ":ST
RIP ne:PAN #8,-20:AT x+2,y:PRINT CHR$(134)
5436 dist1=distance
5438 IF distance<=0 THEN distance=0
5440 IF distance>0 THEN distance=distance+(INT(RND
(1 TO 49))/100)
5445 CSIZE 2,0:STRIP 4:INK 2
5446 AT 11,1:PRINT "YOUR JUMP WAS ";distance;"m"
5450 IF distance<10 THEN AT #4,pos,14:PRINT #4,"0"
;distance: ELSE AT #4,pos,14:PRINT #4,distance
5455 BEEP 1000,1
5460 IF NOT qual AND distance>7.26 THEN qual=1:INK
 0:STRIP 4:AT 13,1:PRINT "YOU HAVE QUALIFIED"
5465 score=score+INT((distance*10)*4)
5470 INK #4,2
5475 IF score>9 AND score<100 THEN AT #4,0,10:PRIN
T #4,score
5480 IF score>99 AND score<1000THEN AT #4,0,9:PRIN
T #4,score
5485 IF score>999 AND score<10000 THEN AT #4,0,8:P
RINT #4,score
5486 IF score>9999 THEN AT #4,0,7:PRINT #4,score
5490 END DEFine
9999 :
10000 DEFine PROCedure draw_shot
10005 INK 0
10010 FILL 1:CIRCLE 15,30,6,1.8,0:FILL 0
10015 INK 6
10020 ARC 50,35 TO 50,25,-1.5
10030 ARC 85,43 TO 85,17,-1.5
10035 ARC 120,46 TO 120,14,-1.5
10040 INK 7
10045 CSIZE 2,0
10050 STRIP 1
10060 AT 21,13:PRINT "7m"
10065 AT 21,23:PRINT "15m"
10070 AT 21,33:PRINT "22m"
10080 print_hi_scores
10092 STRIP 4:INK 0:AT 8,1:PRINT "QUALIFYING DISTA
NCE = 15.28m"
10095 END DEFine
11000 DEFine PROCedure draw_sprint
11010 INK #4,2
11020 AT #4,0,24:PRINT #4,"2"
11025 INK #4,6
11030 AT #4,6,9:PRINT #4,"100m       "
11040 INK #3,2: STRIP #3,7
11050 AT #3,1,1:PRINT #3,"SPEED:"
11060 print_hi_scores
11070 OPEN #6,scr_492x50a10x152
11080 PAPER #6,2
11090 CLS #6
11100 INK #6,7
11110 LINE #6,253,0 TO 303,100
11120 FOR i=1 TO 730 STEP 52
11130  POINT #6,i,0:POINT #6,i,100
11140 END FOR i
11145 CSIZE 2,0
11150 INK 0:AT 8,1:STRIP 4:PRINT "QUALIFYING TIME
= 12.65s"
11200 END DEFine
11999 :
12000 DEFine PROCedure draw_jav
12005 OPEN #8,scr_492x25a10x183
12010 PAPER #8,2: INK #8,7: CLS #8
12020 print_hi_scores
12030 INK #4,2:AT #4,0,24:PRINT #4,"3"
12035 INK #4,6:AT #4,6,9:PRINT #4,"JAVELIN  "
12036 CSIZE 2,0
12040 INK 0: STRIP 4:AT 8,1:PRINT "QUALIFYING DIST
ANCE = 70.23m"
12050 FILL #8,1:LINE #8,1410,100 TO 1330,0:LINE #8
,1450,100 TO 1370,0:FILL #8,0
12060 PAPER #8,1:INK #8,1
12065 FILL #8,1:LINE #8,1451,100 TO 1371,0:LINE #8
,1520,100 TO 1520,0: FILL #8,0
12066 INK #8,6
12070 END DEFine
12999 :
13000 DEFine PROCedure draw_1sprint
13010 INK #4,2
13020 AT #4,0,24:PRINT #4,"4"
13025 INK #4,6
13030 AT #4,6,9:PRINT #4,"200m       "
13040 INK #3,2: STRIP #3,7
13060 print_hi_scores
13070 PAPER #6,2:CLS #6:INK #6,7
13080 LINE #6,253,0 TO 303,100
13090 FOR i=1 TO 730 STEP 52
13100  POINT #6,i,0:POINT #6,i,100
13110 END FOR i
13120 CSIZE 2,0
13130 INK 0:AT 8,1:STRIP 4:PRINT "QUALIFYING TIME
= 21.54s"
13140 END DEFine
13999 :
14000 DEFine PROCedure draw_jump
14005 CLS #7:CSIZE 2,0
14010 INK #4,2:AT #4,0,24:PRINT #4,"5"
14020 INK #4,6:AT #4,6,9:PRINT #4,"LONG JUMP"
14030 INK #3,2: STRIP #3,7: print_hi_scores
14040 INK 0:AT 8,1:STRIP 4:PRINT "QUALIFYING DISTA
NCE = 7.26m"
14050 WINDOW #8,492,25,10,145
14060 PAPER #8,2:CLS #8:INK #8,7:FILL #8,1:LINE #8
,1351,100 TO 1271,0:LINE #8,1400,100 TO 1320,0:FIL
L #8,0
14070 WINDOW #8,492,50,10,133
14080 PAPER #8,6: INK #8,6
14090 FILL #8,1:LINE #8,725,100 TO 660,0:LINE #8,7
80,100 TO 780,0: FILL #8,0
14100 PAN #8,-40
14110 END DEFine
18999 :
19000 DEFine PROCedure hi_scores_2
```

```
19010 LOCal i
19015 hi(event,0)=tme
19020 hi$(event,0)=a$
19025 IF hi(event,0)<hi(event,1) THEN
19030  wr=wr+1
19035  FOR i=3 TO 1 STEP -1
19040   hi(event,i)=hi(event,i-1)
19045   hi$(event,i)=hi$(event,i-1)
19050  END FOR i
19055  RETurn
19060 END IF
19065 IF hi(event,0)<hi(event,2) THEN
19070  hi(event,3)=hi(event,2):hi$(event,3)=hi$(ev
ent,2)
19075  hi(event,2)=hi(event,0):hi$(event,2)=hi$(ev
ent,0)
19080  wr=wr+1
19085  RETurn
19090 END IF
19095 IF hi(event,0)<hi(event,3) THEN
19096  wr=wr+1
19097  hi(event,3)=hi(event,0):hi$(event,3)=hi$(ev
ent,0)
19098  RETurn
19099 END IF
19100 END DEFine
19999 :
20000 DEFine PROCedure draw_main_screen
20010 WINDOW 512,256,0,0
20020 PAPER 4
20030 SCALE 100,0,0
20040 BORDER 5,1
20050 CLS
20060 OPEN #3,scr_511x30a2x226
20070 PAPER #3,7
20080 BORDER #3,1,3
20090 CLS #3
20100 OPEN #4,scr_492x78a10x5
20110 PAPER #4,0
20120 BORDER #4,1,7
20130 CLS #4
20140 INK #4,2
20145 CSIZE #4,2,0
20150 AT #4,0,0:PRINT #4,"SCORE: 00000     EVENT 0
1     LEVEL 0";level
20160 INK #4,5
20180 LINE #4,235,88 TO 235,24
20190 LINE #4,0,24 TO 480,24
20200 INK #4,7
20210 AT #4,2,2:PRINT #4,"FIRST:"
20220 AT #4,3,1:PRINT #4,"SECOND:"
20230 AT #4,4,2:PRINT #4,"THIRD:"
20270 INK #4,3
20280 AT #4,1,24:PRINT #4,"WORLD RECORDS"
20290 INK #4,7
20300 AT #4,2,21:PRINT #4,"1st"
20310 AT #4,3,21:PRINT #4,"2nd"
20320 AT #4,4,21:PRINT #4,"3rd"
20460 INK #4,6
20470 AT #4,6,0:PRINT #4,"  EVENT: SHOT PUTT    WO
RLD RECORDS: 00"
20480 INK #3,2
20490 AT #3,1,1:PRINT #3,"POWER:"
20500 AT #3,1,29:PRINT #3,"ANGLE:":STRIP 5:AT #3,1
,36:PRINT #3,"00 "
20510 END DEFine
20599 :
20600 DEFine PROCedure draw_power
20605 RESTORE 30000
20610 FOR i=8 TO 24 STEP 3
20611  READ col
20615  STRIP #3,col
20620  AT #3,0,i:PRINT #3,"   "
20630  STRIP #3,7,0::AT #3,1,i:PRINT #3,"   "
20660 END FOR i
20670 END DEFine
20999 :
21000 DEFine PROCedure initialise
21005 RANDOMISE
21010 key1=0: key2=0
21015 OPEN #7,scr_492x142a10x84: PAPER #7,4
21020 power=8
21030 score=0
21040 DIM hi(5,4)
21050 DIM hi$(5,3,3)
21060 hi(1,1)=23.82
21070 hi(1,2)=22.15
21080 hi(1,3)=21.45
21085 FOR i=1 TO 5
21090 hi$(i,1)="AAA"
21100 hi$(i,2)="BBB"
21110 hi$(i,3)="CCC"
21115 END FOR i
21120 event=1: events=0
21130 wr=0
21140 hi(2,1)=9.25
21150 hi(2,2)=10.51
21160 hi(2,3)=11.34
21170 hi(3,1)=96.91
21180 hi(3,2)=94.56
21190 hi(3,3)=90.56
21200 hi(4,1)=19.23
21210 hi(4,2)=19.86
21220 hi(4,3)=20.35
21230 hi(5,1)=8.92
21240 hi(5,2)=8.76
21250 hi(5,3)=8.24
21260 round=1
21270 DIM ql(3)
21280 ql(1)=4000
21285 ql(2)=3500
21290 ql(3)=2500
21900 END DEFine
21999 :
22000 DEFine PROCedure print_hi_scores
22005 INK #4,6
22010 IF wr<10 THEN AT #4,6,38:PRINT #4,wr
22020 IF wr>9 THEN AT #4,6,37:PRINT #4,wr
22030 INK #4,7
22040 FOR i=1 TO 3
22045  IF hi(event,i)<10 THEN
22050   AT #4,i+1,27:PRINT #4,"0";hi(event,i)
22055  ELSE
22057    AT #4,i+1,27:PRINT #4,hi(event,i)
22058  END IF
22060  AT #4,i+1,37:PRINT #4,hi$(event,i)
22070 END FOR i
22080 END DEFine
22099 :
22100 DEFine PROCedure screen
22105 CLS #7
22110 CSIZE 3,1: INK 1,2: STRIP 4
22115 AT 6,8:PRINT "END OF EVENT ";event
22135 FOR i=1 TO 2000: END FOR i
22150 BEEP 200,5
22155 events=events+1
22160 END DEFine
22199 :
22999 :
23000 DEFine PROCedure f_level
23010 WINDOW 512,256,0,0
23020 PAPER 4
23030 STRIP 1: INK 6
23040 CSIZE 2,1
23050 BORDER 5,5
23060 CLS
23065 AT 0,7:PRINT "T R A C K  and  F I E L D"
23070 INK 0: CSIZE 2,0: STRIP 2
23080 AT 3,10:PRINT "FOR THE SINCLAIR QL"
23090 INK 7:STRIP 0:AT 5,14:PRINT "by A.DIDCOCK"
23100 INK 1:STRIP 4
23120 AT 12,2:PRINT "1/ Simple"
23130 AT 14,2:PRINT "2/ Medium"
23140 AT 16,2:PRINT "3/ Difficult"
23145 INK 0
23150 AT 10,0:INPUT "WHICH LEVEL DO YOU WANT TO PL
AY ON ? ";level
23155 BEEP 500,5
23160 IF level<1 OR level>3 THEN GO TO 23150
23165 level1=level
23170 OPEN #5,scr_512x180a0x75
23180 PAPER #5,4
23190 BORDER #5,4,5
23200 CLS #5
23210 INK 1
23220 AT 12,8:PRINT "(HAS TO BE 3 CHARACTERS)":AT
15,2:PRINT "eg. INITIALS: ADD"
23230 INK 0
23240 AT 10,7:INPUT "ENTER YOUR IDENTIFYING CODE:
";a$
23245 BEEP 500,5
23250 IF LEN(a$)<>3 THEN GO TO 23240
23260 END DEFine
23999 :
24000 DEFine PROCedure end_routine
24005 BORDER: BORDER 5,1
24010 PAPER 4:CLS
24020 CSIZE 2,0:INK 1,2:STRIP 4
24030 AT 1,7:PRINT "YOU HAVE FAILED TO QUALIFY "\\
"          FOR THE NEXT EVENT"
24040 INK 2
24050 AT 7,1:PRINT "YOU SCORED ";score;" POINTS"
24060 AT 9,6:PRINT "AND ACCUMULATED ";wr;" WORLD R
ECORDS"
24070 AT 11,20:PRINT "ON LEVEL ";level1
24080 INK 0
24090 AT 13,1:PRINT "YOU ALSO COMPLETED ";events;"
 EVENTS"
24095 IF score>hiscore THEN hiscore=score
24096 AT 15,9:INK 2,0:PRINT "THE HI-SCORE IS ";his
core
24100 INK 1
24105 FOR i=1 TO 2000:END FOR i
24110 AT 19,6:PRINT "PRESS ANY KEY TO PLAY AGAIN"
24120 PAUSE 40000
24130 BEEP 300,10
24140 END DEFine
24999 :
25000 DEFine PROCedure next_level
25005 reset
25010 CLS #7:CSIZE 3,1:INK 1,2:STRIP 4
25020 AT 5,10:PRINT "WELL DONE"
25025 INK 2:CSIZE 2,0
25030 AT 14,4:PRINT "YOU HAVE COMPLETED ALL THE EV
ENTS"\\"            IN ROUND ";round
25040 round=round+1
25050 IF (score/(round-1))<ql(level1) THEN qualify
=0: ELSE qualify=1
25060 INK 0
25070 IF qualify THEN FLASH 1:AT 18,2:PRINT "YOU H
AVE QUALIFIED FOR THE NEXT ROUND":FLASH 0
25080 FOR i=1 TO 3000:END FOR i
25085 CLS #7
25090 END DEFine
29999 :
30000 DATA 5,1,6,4,3,2
31999 :
32005 start=RESPR(100)
32010 a0=65537
32020 a2=start+6
32030 RESTORE 32100
32040 FOR i=0 TO 70: READ byte: POKE start+i,byte
32050 CALL start,0,0,255,37,0,0,0,a0,0,a2
32060 GO TO 7
32099 :
32100 DATA 32,4,78,67,78,117
32110 DATA 128,7
32120 DATA 96,112,24,92,124,12,20,36,76
32130 DATA 100,104,112,112,96,96,80,72,108
32140 DATA 24,24,48,52,60,48,56,40,76
32150 DATA 24,24,48,48,48,48,16,16,48
32160 DATA 88,88,112,52,60,48,56,40,76
32170 DATA 88,88,112,48,48,48,16,16,48
32180 DATA 0,48,48,96,120,96,124,0,0
```

SPECTRUM CONNECTIONS 2

Rob Miles shows you how to transfer your favourite screens across from Spectrum to QL.

The QL has over four times the screen memory of the Spectrum, allowing it to display detailed pictures in eight colours. Unfortunately at the moment all the best artwork is being produced for the Spectrum. The following programs allow you to transfer screens from the Spectrum to the QL. The QL screen is then stored and you can use one of the QL artist programs (reviewed in this issue) to add to the detail in the picture, producing spectacular versions of favourite screens!

Two versions of the programs are given here, one using the Network communications and the other using the RS232. The network one is the easiest to connect, you can use the lead supplied with the QL, but it can be unreliable. The RS232 version is much more reliable, but you will need to assemble a lead as outlined last month.

To start a transfer first run the program in the QL, this will ask you for the name of the microdrive file into which to load the picture. Give the name of a file and press RETURN. Then run the program in the Spectrum. The Spectrum program loads the screen you wish to transfer from cassette and then begins to ship it to the QL. The border colour on the Spectrum will flicker as the link operates and the picture will build up on the QL screen.

When the screen has been transferred to the QL it is automatically saved on the device you specify, so before you run the program make sure that there are at least 65 sectors available, nothing is more heartbreaking than to watch an entire screen go across, only to have it fail to save at the end!

Because the QL and the Spectrum have different numbers of pixels down the display the screen is 'stretched' as it is transferred. This can make the pages of text (if you ever transfer such things!) look rather strange. You can turn off this stretching if you wish by changing the following lines in the QL programs:

QL Network Program Changes

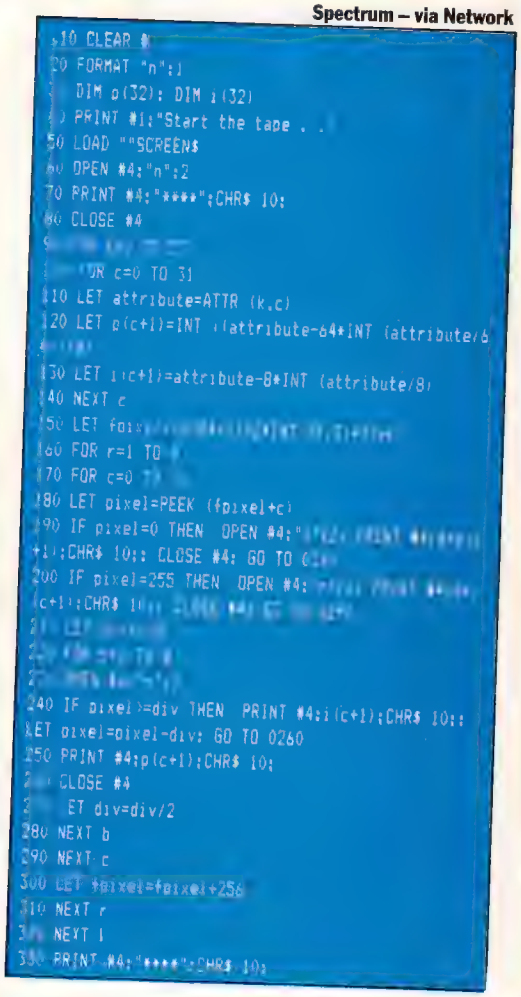
240 bht=1
350 yval=yval+1

QL RS232 Program Changes

230 bht=1
340 yval=yval+1
440 END DEFine getlin

QL – via Network

Spectrum – via Network



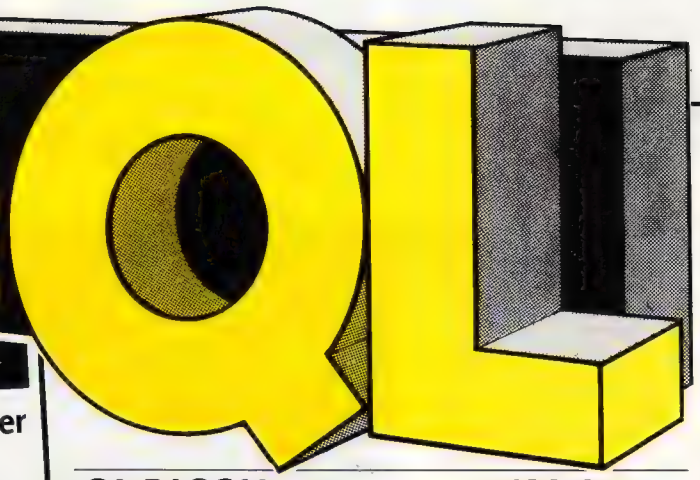
```
10 CLEAR #
20 FORMAT "n";1
   DIM p(32): DIM i(32)
40 PRINT #1;"Start the tape . .
50 LOAD ""SCREEN$
60 OPEN #4;"n";2
70 PRINT #4;"****";CHR$ 10;
80 CLOSE #4
   FOR c=0 TO 31
110 LET attribute=ATTR (k,c)
120 LET p(c+1)=INT ((attribute-64*INT (attribute/6
130 LET i(c+1)=attribute-8*INT (attribute/8)
140 NEXT c
150 LET fo
160 FOR r=1 TO
170 FOR c=0
180 LET pixel=PEEK (fpixel+c)
190 IF pixel=0 THEN  OPEN #4;"
+1);CHR$ 10;: CLOSE #4: GO TO
200 IF pixel=255 THEN  OPEN #4:
(c+1);CHR$ 1
240 IF pixel>=div THEN  PRINT #4;i(c+1);CHR$ 10;:
LET pixel=pixel-div: GO TO 0260
250 PRINT #4;p(c+1);CHR$ 10;
   CLOSE #4
   ET div=div/2
280 NEXT b
290 NEXT c
300 LET fpixel=fpixel+256
310 NEXT r
   NEXT i
330 PRINT #4;"****";CHR$ 10;
```

QL – via RS232

```
100 REMark Pictrans
110 MODE 8
120 WINDOW 512,256,0,0
130 PAPER 0
140 CLS
150 INPUT "File name for picture"';"(including Devi
ce)",fnam$
160 OPEN #3,ser1
170 REPeat sync
180 getlin d$
190 IF d$="****" THEN EXIT sync
200 END REPeat sync
210 yval=0
220 FOR v=0 TO 191
230 bht=4*(v MOD 32)
240 xval=0
250 REPeat showlin
260 IF xval>=512 THEN EXIT showlin
270 getlin c$
280 IF c$="****" THEN v=1000:EXIT showlin
290 block_width=2+(14*(c$ DIV 8))
300 block_colour=c$ MOD 8
310 BLOCK block_width,bht,xval,yval,block_colour
320 xval=xval+block_width
330 END REPeat showlin
340 yval=yval+(v MOD 32=0)
350 END IF
360 NEXT v
370 SBYTES fnam$,131072,32768
380 STOP
390 DEFine PROCedure getlin(lin$)
400 INPUT #3,lin$
410 RETurn
420 END DEFine getlin
```

Spectrum – via RS232

RELEASE THE POWER OF THE QL



QL C £99.95 INC. VAT

New - a professional specification C Compiler for the QL! Designed by LATTICE®, QL C is a complete implementation of the Kernighan and Ritchie definition of C. QL C is endorsed by Sinclair Research; it is the most powerful and fully featured C compiler available for the QL.

- > Complete Kernighan and Ritchie implementation.
- > Proven LATTICE® design, compatible with LATTICE® compilers on IBM PC, etc.
- > True compiler producing native 68000 code.
- > Full floating point arithmetic.
- > Powerful data types such as pointers, arrays, structures, and unions.
- > Comprehensive library of UNIX, QDOS and utility functions.
- > Over 90 detailed error messages.
- > Separate compilation.
- > Macros, conditional compilation, and other pre-processors.
- > Linker to link program modules; will also link to other relocatable binary modules.
- > Chosen by Sinclair Research as the C Compiler for the QL.

Every DEVELOPMENT KIT includes Metacomco's popular screen editor, and a detailed manual. All KITs will operate either on a standard QL or else using QL peripherals such as floppy disks or memory expansion.

Available from W.H. Smith, John Lewis, HMV, Menzies, Dixons and other leading retailers or direct from Metacomco.

METACOMCO

26 Portland Square, Bristol BS2 8RZ.
Tel: Bristol (0272) 428781

Trademarks: UNIX-AT+T Bell Laboratories, QL, QDOS - Sinclair Research Limited.

QL PASCAL £89.95 INC. VAT

Pascal compiler which conforms fully to the ISO 7185 international standard. Approved by Sinclair Research.

Features: fast single pass compilation — no intermediate stages; produces native 68000 code; full ISO 7185 level 0; direct addressing of complete QL address space; easy to use QDOS interfaces; very large sets and arrays.

ASSEMBLER £39.95 INC. VAT

A high specification macro assembler supporting the full Motorola instruction set.

Features: external references; absolute, position independent, and relocatable code; linker; precise error messages; formatted listings; macro expansions; conditional assembly; and a large range of directives.

BCPL £59.95 INC. VAT

A true compiler, ideal for systems programming - writing utilities, games and applications.

Features: generates native 68000 code; run time library includes easy QDOS interfaces; link loader links separately compiled segments; modules can be linked with Pascal or Assembler.

LISP £59.95 INC. VAT

A LISP interpreter for exploring "The language of artificial intelligence".

Features: Turtle graphics; compatible with LISP for the BBC micro; full support of QL features; structure editor; prettyprinter; garbage collector and tracer.

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Please send me QL C £99.95 ☐ QL PASCAL £89.95 ☐ ASSEMBLER £39.95 ☐ BCPL £59.95 ☐ LISP £59.95 ☐ MORE INFORMATION ☐ I enclose a cheque for £ _____ or debit my ACCESS/VISA No: ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐ Card Expiry Date _____

NAME _____

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Price includes VAT, postage and packing UK mainland only. Delivery, allow up to 28 days QL 11

SOFTWARE FILE

Marcus Jeffery gives the low-down on the QL software scene.

Master Blaster

Its name sounds more like a pop group than a computer game, but *Master Blaster* is certainly going to be popular amongst the QL fraternity.

With a name like that, I bet you think its an alien 'shoot 'em up'. Well, you're very nearly right, only the enormous variety of aliens don't look very alien at all. You know, not mean enough! But be warned. Remember the wolf in sheep's clothing. The screenfuls (20 in all) of nasties go careening about the screen in all manner of wild courses being thoroughly obnoxious to us poor, humble players.

What have they got against us anyway? Just because we're chucking a bullet or two at them. You won't be chucking very many in this game, because you're only allowed one bullet on the screen at any one time. Normally, I'd mark a game down for this. After all, its the quickness of the finger on the fire that's part of the skill. However, in this particular case, the one shot technique merely adds to the frustration and the addiction. You just have to sit there watching your bullet work its trouble-free way to the top of the screen, whilst you're set upon by hordes of the bad guys. These aren't, however, your usual bunch of baddies, as they move in unpredictably disturbing ways in order to destroy another brave pilot.

One of the keywords of this game is variety. The first screen seems fairly ordinary, but you will eventually make your way past it, though not necessarily with many ships left. The second screen has a number of planes doing saturation bombing – I never knew planes could carry so many bombs. Later screens have dropping eggs, which quite naturally break, then hatch into birds which have an annoying habit of flying right off the top of the screen, then back on at the bottom, catching you unawares from behind – very nasty. Even more painful are the bouncing balls! Another memorable screen was a gardener's paradise, with seeds dropping from heaven which blossom into deadly flowers. These were probably precipitated by the clouds on yet another screen which dampened – well, flooded – the ground.

The smooth graphics and an imaginative variety of screen plays are bound to make this game a winner. Having said this, in all honesty the game, though of high quality, is still not as good as the best of what's available on the smaller cheaper micros. Let's hope that the new low price of the QL will encourage people to start making better use of its facilities on the games front. In the meantime, you could do a lot worse than to go out and buy this one.

CompuGem

An all-action screen from Master Blaster

Request for information from Equate

The aptly-named Shrub Data Bank & Planner

Equate

Somebody once asked me what the definition of a graph curve is, only to inform me that it is someone with a mathematical bent!

A bit lame maybe! But if it applies to you, then you may be interested in *Equate* from Flite. This is a package for handling graphical equations and displaying them on-screen. Options allow you to input equations and display both the graph and its differential. Simpson's Rule will calculate integrals and the Newton Raphson method will calculate roots. You can also solve simultaneous equations, or even define points of a graph and get the system to find a best line of fit (straight, cubic or whatever).

To be honest, the applications seem fairly limited. If you know enough mathematics to use the package properly, then you can probably work out the answers fairly easily using a pocket calculator. Whereas users who have a genuine application in mind will be better off with more specialised software. The question is, do you want pretty pictures or quick results?

Flite

Shrub Data Bank and Planner

Are you a member of the Green Thumb Brigade? The blurb reckons that the *Shrub Data Bank and Planner* will be of interest to all QL owners having gardens and to small businesses such as

Nurserymen, Farmers and Florists. Well, I'm a QL owner with a garden, so here goes.

The package uses Psion's third party Archive Run Time Module to create a gardening database. This contains information on 287 common shrubs, trees and climbers, such as typical size, characteristics, preferred habitat and soil, flowering seasons, and so on. All useful stuff. The package also includes the facility for you to add your own items using Archive, expanding the database.

Having tried out all the features of the rather basic finished product, I came to the conclusion that I couldn't think of anybody who would want the product. I'm sure that experienced gardeners would know what sort of plant would suit any particular situation, without having to wait ages for the QL to find it for them. Whereas novice gardeners would be much better advised to drop in at their local garden centre, get somebody's advice, and be able to see the plant they're thinking of buying.

Then again, if this is really what you want, then here it is. What's more, another four additional plant data banks are supposed to be on their way.

Superplant Software

Four In One

With four 100% machine code games on one tape for £11.95, you're probably thinking that the games aren't up to much. You're right: Nevertheless, let's look at each of the games.

Food Freak refused to load, but the documentation states that you must move Food Freak around a screen as quickly as possible eating the food. Fast food scores more points. The game ends when you hit your third poisonous toadstool, or after sixty seconds.

Fire Tower consists of a towering inferno look-alike where all the occupants are throwing fate to the wind as they hurl themselves from the windows. Your job is to dash left and right along the bottom of the screen, doing your best to catch them in a blanket, held taut by a couple of muscular firemen. Due to the multitude of "jumpers", saving them all is impossible. However, too much enthusiasm tends to find them landing on the poor firemen, resulting in their deaths. The game ends when all the windows are aflame.

Advance Attack is a typical alien shoot 'em up. The aliens (there seem to be about three or four different types) move fairly randomly about the screen, throwing out the odd death ray and steadily descending. You move along the bottom of the screen in your now familiar spaceship zapping away for all it's worth. You have three lives which are lost by any alien reaching the ground, or when hit by a death ray. Alternatively like the first, the game ends after sixty seconds.

Life on the ocean wave may be okay for some, but I doubt that even the most dedicated mariner would care to risk life and limb in the shark-infested waters of *Pirate Island*. Certainly not for three unspecified "prizes". The idea is to move Peter the Pirate to a wreck and a small island at the top of the screen, avoiding the rapidly moving shark fins. This is more difficult than it sounds. Especially when the sharks are talented enough to eat you even when only knee-deep in the water!

Upon reaching the wreck, searching the stern will lead to the squid screen, where you have to avoid the deadly tentacles to collect your prize. The bows lead to a very simplistic levels and ladders screen, where you have to avoid killer apes. Alternatively, you could head for the island beach and make for the prize in the cave entrance. However, I didn't last more then a couple of seconds under the rain of rocks from the belligerent natives. Having failed miserably on the beginners, I suppose it was stretching my luck to try the advanced version of *Pirate Island* (supplied on the cartridge). However, this version didn't seem to be any more difficult, and I fared just as well. A reasonably original game idea, but I'd rather be splicing the mainbrace any day.

Due to the lack of games software available for the QL, this four-in-one package is possibly worth the price. Be warned, however, that on any other micro, it is dubious that any of the games would ever be published.

Victory Software

Touch 'n' Go

Touch 'n' Go is an adaptation of the Harcourt System Typing Tutor. Teach, or rather re-teach if you're new to the QL keyboard, yourself typing.

This course takes you from simple beginnings, such as using the correct finger for each key, and so on, through a series of over sixty exercise sections. According to the documentation, the course will take you to a typing speed of 30 words per minute with 95% accuracy. However, the final tests on our copy were 45 words per minute.

Not all the tests fit into memory simultaneously, so reloading from microdrive is fairly frequent. So that you don't waste time waiting for the sections to load, they are accessed in advance, whilst the tests continue. Unfortunately, this increases the time it takes to process a key press, which, in any case, is not particularly fast to begin with. The only other major complaint is with the definition of "accuracy". If you've finished a sentence, and mistyped, say, just one character then you will be allowed to continue. However, inserting or omitting a character (again just one mistake) will unintelligently highlight a large part of the line as being wrong. Not that we made many mistakes!

Harcourt

Reversi

Historically speaking, Reversi was first invented and patented in Britain. Then recently those inscrutable Japanese filched the idea, stipulated that the first four stones must be placed diagonally on the centre squares to create a "different" game, called it Othello, then with a little marketing they made lots of money. Pretty clever, huh?

Which is more than can be said for this rather poor SuperBasic version of the game – called *QL Reversi (Note. This is not to be confused with the confusingly-named QL Reversi being marketed by Sinclair and credited to Games of Skill – Ed)*, it plays the more common Othello. The program allows eight levels of play, though the only difference these seem to make is the total time you're allowed for all your moves. Consequently, I found Level Eight quite difficult – well, you try playing 34 stones in just one minute! Trying out Level Seven, this self-confessed poor player was beating the electronic daylights out of the computer when it decided to crash with an "At line 10050 – not complete", just as I was about to collect the first of my four corners. This I suppose is computing's equivalent to kicking over the board and knocking all the pieces to the ground in a fit of pique.

What can I say? If you happen to find yourself walking into a shop to buy this, just reversi about and walk back out again!

Soft School

Babel Soft

QL-Grafik is a sprite editor and driver. Not only did we manage to work this out, but we also managed to define a multicoloured Sprite of the Liberator (of Blake 7 fame). Having done this we were stuck. The problem being that the comprehensive-looking instructions were entirely in German, which nobody in the office speaks. Well, why should we, when the QL is a British machine?! The good news is that the programmers had seen fit to include plenty of help screens in the package. The bad news is that these were also in German!

Hopefully, if and when this package is marketed in Britain (at present it's published by Verlag and Keisenberg), it'll have English translations to all the documentation. Nevertheless, the projected £25 seems rather high, even if it turns out to be an excellent sprite designer/driver.

Verlag & Keisenberg Software

SUPPLIERS

Compugem, *13 Amblerthorne, Birkenshaw, Bradford*
Master Blaster: £9.95

Flite Software, *Pearse Road, Letterkeeney, Co Donegal, Eire*
Equate: £39.95

Soft School, *471 Hornsey Road, London N19*
QL Reversi: POA

Sinclair Research, *Stanhope Road, Camberley*
QL Touch and Go: £24.95

Superplant Software, *Llangeitho, Tregaron, Dyfed, Wales*
Shrub Data Bank & Planner: £19.95

Verlag & Keisenberg, *Postfach 579, D-4600 Dortmund 1, West Germany*
QL-Grafik: £25 (approx)

Victory Software, 8 Berkely Close, Staines, Middlesex
Food Freak, Fire Tower, Advance Attack & Pirate Island: £11.95

SUPERCHARGE
SUPERBASIC COMPILER

NEW!

★ This amazing compiler translates QL SuperBasic into 68008 machine code, completely automically! It supports the entire syntax of SuperBasic (except, obviously, commands like EDIT/LIST/RENUM which are specific to Basic and would be meaningless in machine code). That means all file handling, multidimensional arrays, procedures (with parameters too), local variables, strings, sound, graphics, separate superspeed integer, floating point arithmetic (displaying Nine Digits of Precision versus The Interpreter's Seven!), extensions to Basic, the complete range of SuperBasic control constructs . . . refer to your QL User Guide for the whole list!

★ The code generated by Supercharge runs incredibly fast – here are the standard PCW benchmarks (PCW June 1984) for QL Basic compared with the timings for the same programs when Supercharged:

BENCHMARK NUMBER	1	2	3	4	5	6	7	8
SUPERBASIC (SECS)	2.1	6.4	10.7	10.3	13.2	26.1	61.8	25.8
SUPERCHARGE (Floating Point) (SECS)	**0.2**	**0.3**	**1.2**	**0.9**	**1.0**	**2.5**	**4.1**	**8.6**
SUPERCHARGE (Integer) (SECS)	**0.06**	**0.1**	**0.3**	**0.3**	**0.3**	**0.7**	**1.0**	**N/A**

(Variations will exist between different QL systems)

Hence on standard benchmarks a 60× speed increase is possible . . . SUPERCHARGE, however, is at its least impressive when compiling such short programs, as SuperBasic grows slower as program size increases. Speed improvements of **SEVERAL HUNDRED TIMES** are in no way uncommon when using SUPERCHARGE on programs of average size.

★ SUPERCHARGED programs are independent jobs (so you don't need to have SUPERCHARGE loaded to run them).

★ SUPERCHARGED programs are relocatable and are inherently multitasking (so you can run any number of them at once).

★ SUPERCHARGE optimises as it compiles – and the advanced user may switch the optimisation from time to space on a line by line basis.

★ SUPERCHARGED programs load far more quickly (at least 5-10 times) and, hence reliably, than normal SuperBasic – there is no pause between blocks

★ SUPERCHARGE can compile programs of ANY size, provided you have enough RAM on board (for the unexpanded QL, the limiting source code size is still a massive 40K!). Compilation listings can be directed to any device – and a complete set of compile/run time error messages (clear and unambiguous, unlike the Interpreter's!) are issued, showing exact error positions.

★ Add-on commands, functions and procedures are allowed by SUPERCHARGE, provided they do not read/alter Interpreter data structures . . . Hence utilities supplied with disk systems and QL Toolkits will work with SUPERCHARGE!

★ SUPERCHARGE is compatible with all disk and memory-expansion systems. The system we recommend (on grounds of quality, speed and reliability) is the one we used in developing SUPERCHARGE – the CST disk system, available from Computamate (Scotia Road, Burslem, Stoke-on-Trent – Tel: 0782 811711) or from us – write in for details.

★ SUPERCHARGED programs are protected against unauthorised modification/listing/tampering – permanently.

★ SUPERCHARGE is the only QL Compiler which offers the user the convenience of interactive testing, editing and debugging.

★ SUPERCHARGE cures most bugs and lifts many of the restrictions imposed by the Interpreter! Examples of problems completely cured under SUPERCHARGE: "Too many parameters in a procedure" bug; the RESPR bug, GOSUB in a single-line FOR statement, CALL in long programs, procedure parameters/integer/string variables used in SELECT statements, full integer arithmetic, etc, etc.

★ SUPERCHARGE adds a number of new commands to SuperBasic, including ones to monitor device statuses, to list/stop/remove tasks, to change task priorities, and so on.

★ SUPERCHARGE is supplied either on disk or microcartridge and can be easily transferred/backed up from one to the other.

★ SUPERCHARGE is supplied with a superb Instruction Manual (40,000 words) designed to complement the User Guide – it is designed for both beginner and advanced user, with sections on "Getting The Best From SUPERCHARGE" and many examples.

★ SUPERCHARGE itself loads and runs phenomenally fast – yes, SUPERCHARGE is itself a SUPERCHARGED program!

£59.95 COMPLETE WITH DETAILED MANUAL (specify cartridge or CST diskette)

AVAILABLE NOW!

Author: Simon Goodwin. Assistant: Gerry Jackson. Mission Control: Freddy Vachha.

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AD INDEX

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Compugen ..... **Supp**
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Computer Repair Centre **38**
Cumana ..... **28 & 29**
D.D.L. ..... **IBC**
Digital Precision ..... **52 & 53**
Eidersoft **9**
English Software **22**
Epson **4**
Flite Software ..... **Supp**
Four Systems **14**
Medic Data Systems ..... **6 & 7**
Metacomco **49**
Microdeal ..... **IFC**
Miracle Systems Ltd ..... **Supp**
Printerland ..... **Supp**
Silicon Express ..... **18 & 19**
Strong Computers Ltd **30**
Talent Computers ..... **OBC & 33**
Tandata Ltd ..... **36 & 37**
Technology Research Ltd **21**
Total Computability ..... **Supp & 22**
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ABACUS

The Extending Spreadsheet

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Published and Distributed by EMAP Business & Computer Publications.

Subscriptions, backnumbers and reprint information from: Carl Dunne (Magazine Services) on 01-251 6222 Ext 2429.

U.S. Sales Agent – Motorsport, RR1, Box 200D, Jonesburg, MO 63351.

Typesetting by Crawley Composition Ltd, Stephenson Way, Three Bridges, Crawley.

Printing by Riverside Press.

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Abacus transforms the QL into a powerful but easy to use number crunching machine. It does this by providing the user with a grid measuring 64 rows by 255 columns. At every intersection of a row and column is a 'cell' which can contain either numerals, text or formulae and which may be linked up to any other cell in a variety of ways. In theory this means that the program can juggle a massive 16320 different sets of figures simultaneously. In practice, with only 22K of memory (version 2.00) set aside (on an unexpanded QL) the figure works out at somewhere between 600-1000 sets. Even then this is sufficient for most complex analyses.

Single Entry

Entering one-off items onto the spreadsheet is quite simple.

1. Position the cursor using the cursor keys at the appropriate cell you wish to fill
2. Type in a value which displays on the input line at the foot of the screen. If text is to be entered precede your entry with " (quotes) ie: "Month1.
   Whilst a line is being entered it may be edited using combinations of the cursor keys allied with [CTRL] and [SHIFT]. (cf Quick reference chart)
3. When the entry is complete press [ENTER] and the values or characters typed will appear in the cell where the cursor is located.

If any problems are encountered entering an item simply press [ESC] to abort the process and try again.

Amending an Entry

Once an item has been entered it may be amended by positioning the cursor over the target cell and either overwriting the contents or pressing [F3+A] whereupon the input line will fill with the existing contents of that cell which may then be edited using the cursor keys.

Deleting Entries

The contents of a cell or range of cells may be erased using the RUBOUT command [F3+R]. The range of cells to be deleted is defined using the top left hand cell reference of a block followed by the bottom right hand reference. For example instead of using [F3+Z] to delete the entire grid you could use [F3+R] and specify the range as A1:BL255. If no range is specified then only the current cell will be emptied.

It is very important to use the rubout feature instead of simply entering a zero or blank as in the latter case the cell remains active with memory reserved for it.

Simple Formulae

Entering figures on a spreadsheet isn't much use unless we can manipulate them. Fortunately, Abacus provides a wealth of functions for such a purpose.

SUMming Up

The function SUM is used to add up contents of columns (or rows) on the grid. It can be employed in a variety of ways. One of the simplest is to position the cursor at the foot of a column, C9 in Fig 1, and enter:

sum(col)

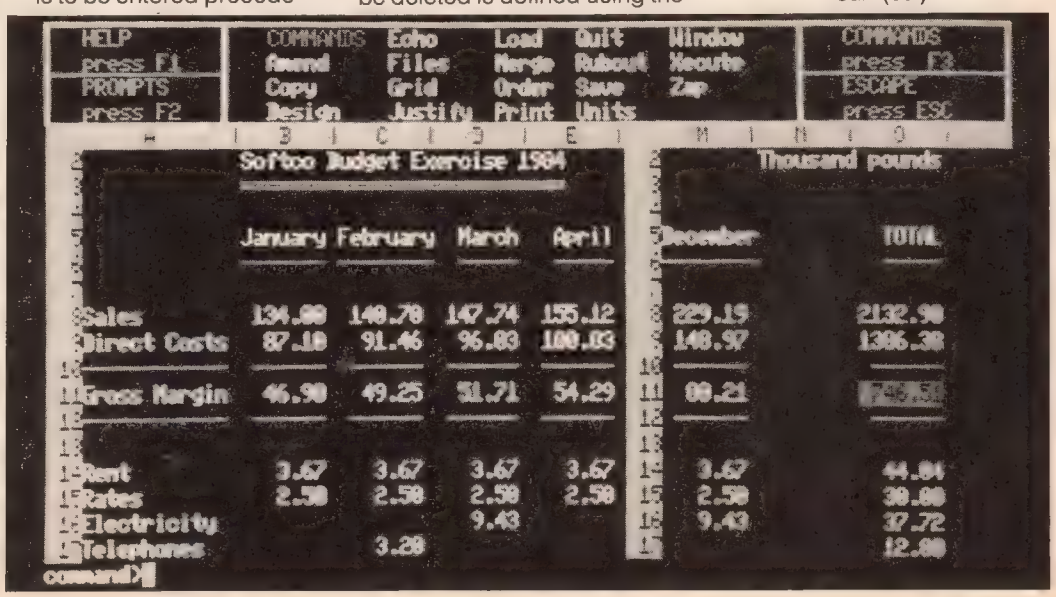
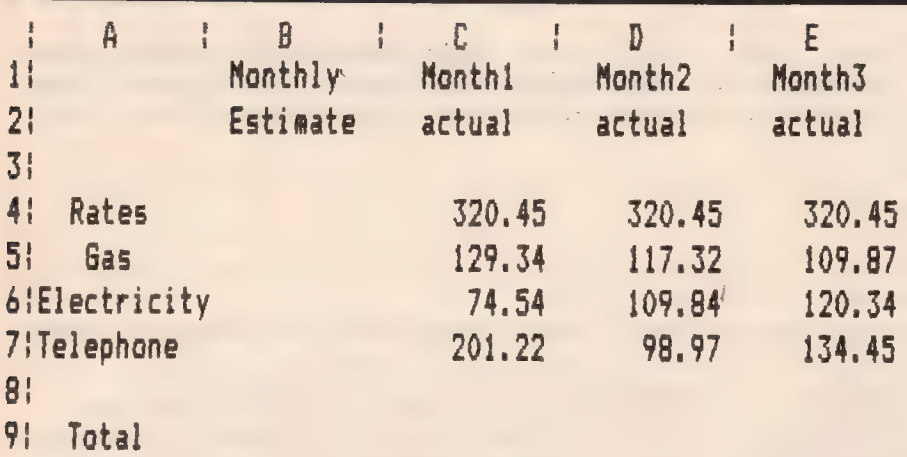


FIGURE 1



	A	B	C	D	E
1		Monthly	Month1	Month2	Month3
2		Estimate	actual	actual	actual
3					
4	Rates		320.45	320.45	320.45
5	Gas		129.34	117.32	109.87
6	Electricity		74.54	109.84	120.34
7	Telephone		201.22	98.97	134.45
8					
9	Total				

after you have pressed ENTER you will be required to specify where in the column Abacus is to start its summation FROM and up TO which point it is to continue. In *fig 1* the entire command would appear as follows

sum(col) . . . FROM 4 TO 7

As Abacus is capable of using text on the grid as a reference (provided that it is unique) we could simplify our command to:

sum(Month1) . . . FROM 4 TO 7

In our example spreadsheet, you could repeat the method for Month2 etc. However, all the columns can be added up in one fell swoop if we position the cursor at B9 and enter:

row=sum(col) . . . FROM 4 TO 7 FROM B TO N

You may wonder why we have included columns B, and F to N in our calculations. The reason for this is that when we come to insert values over the range 4 to 7 in these columns the spreadsheet will tot them up without our having to issue any further commands. Until such values are added it may be an idea to tidy up the spreadsheet by blanking out zeros. To do this press [F3+D+B].

AVEraging

Turning our attention to column B ("Monthly Estimate). Let us assume that we wish to fill this with the average of all previous months. Then positioning the cursor at B4 we could enter:

ave(rates) . . . FROM C TO N

However, as we are going to apply this averaging formula to all four rows, a more efficient way of doing so would be (with the cursor at F4):

col=ave(row) . . . FROM C TO N FROM 4 TO 7

Our spreadsheet will now appear as Figure 2.

"What If" Analysis

If you now insert figures for, say "month4", in column F the month's total will automatically display in cell E9 and the "Monthly estimate" will be recalculated averaging out over 4 periods instead of three.

A similar 'ripple' effect will occur if any of the existing figures for rates, gas etc are amended. This feature, common to most spreadsheets, provides an extraordinarily powerful analytical tool, allowing the user to quickly gauge the impact of a minor change upon a complex whole.

Design and order of calculation

Careful thought should go into working out the structure of a spreadsheet especially in placement of columns and rows. It is good practice to enter text first (ie labels and headings), then work out your formulae and last of all enter your figures.

An important consideration when determining what goes where on a spreadsheet is the order of calculation. Abacus will calculate rows (from left to right) and then columns (from top to bottom) unless instructed to do otherwise [F3+D+C]. Failure to take order into account can result in some surprising results as we shall see when we expand our example spreadsheet. A good rule of thumb for those inexperienced in Abacus programming is to issue an (extra) Xecute command [F3+X]. This will perform any calculations missed in the first pass.

Splitting Image

When a spreadsheet expands to fill the entire screen it is often useful to split it in two so that, for example, labels and headings continue to display providing a useful guide for input. Also, as both parts of the split screen remains active used to monitor changes in important areas of the sheet obviating the need to constantly jump back and forth from one area to the next. To do this with the spreadsheet in *Fig 2*, position the cursor at C1 and press [F3+W+V+T]. You should now find it very much easier to enter figures for later months and also monitor how the estimate monthly figures vary.

Tidying Up

It is a good idea at this stage to tidy our spreadsheet up (see *Fig 3*). Using F5 to position the cursor at the desired cell enter the following formulae:

Cell	*Formula*	*Range*
C1	**row=month (col()−2)**	**C** to **N**

This will fill out C1:CN with actual month names. Col() returns values from the grid's border column (ie 1 to 255).

Cell	*Formula*	*Range*
F2	**row= "forecast"**	**C** to **N**

Repeat the string "forecast" across remainder of range.

Cell	*Formula*	*Range*
B3 and B10	**row=rept("=", width())**	**B** to **N**

FIGURE 2

	A	B	C	D	E
1		Monthly	Month1	Month2	Month3
2		Estimate	actual	actual	actual
3					
4	Rates	320.45	320.45	320.45	320.45
5	Gas	118.84	129.34	117.32	109.87
6	Electricity	101.57	74.54	109.84	120.34
7	Telephone	144.88	201.22	98.97	134.45
8					
9	Total	685.75	725.55	646.58	685.11

FIGURE 3

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1		Monthly	January	February	March	April	May	June	July	August	September	October	November	December
2		Estimate	actual	actual	actual	forecast	forecast	forecast	forecast	forecast	forecast	forecast	forecast	forecast
3														
4	Rates	£320.45	£320.45	£320.45	£320.45									
5	Gas	£118.84	£129.34	£117.32	£109.87									
6	Electrici	£101.57	£74.54	£109.84	£120.34									
7	Telephone	£144.88	£201.22	£98.97	£134.45									
8														
9	Total	£685.75	£725.55	£646.58	£685.11									
10														

Double underline. Here the width() returns the cells width and will cope with cells of differing width.

Cell	*Formula*	*Range*
B8	**row=rept("–", width())**	**B** to **N**

Also to improve readability of the spreadsheet it may be an idea to alter justification, centering text [F3+J+[ENTER]+C] and change over to monetary units [F3+U+[ENTER]+M]. So that subsequent entries will be similarly affected we repeat the previous commands this time altering the 'default' settings. (A default is merely something that is preset for convenience).

Saving a spreadsheet

To save a spreadsheet simply press [F3+S] and then specify a device and filename. (ie *mdv1_fig3*). In common with standard conventions on the QL file names should be no longer than seven characters in length, contain no symbols or spaces and begin with a letter of the alphabet.

Relative or Absolute

Returning to our example spreadsheet. Let us assume that we've just got wind of the following information effective April onwards:

"Telephone bills to increase by 10% monthly"
"Electricity to rise by 12.5% monthly"
"Gas to decrease by 10% monthly"
"Rates to increase by 30% in April and remain fixed thereafter"

Taking March as our base we can implement these forecasts as follows:

Cell	*Formula*	*Range*
F7	**row=tel. mar*1.1**	**F** to **N**
F6	**row=ele. mar*1.125**	**F** to **N**
F5	**row=gas. mar*9**	**F** to **N**
F4	**row=$rates. mar*1.3**	**F** to **N**

In all but the last entry the forecasts have been calculated relative to the cell immediately preceding it. This relationship applies when ECHOing or COPYing formulae into other cells as well. Indeed, Abacus assumes that all cell references are relative unless the reference is preceded by a $ (dollar sign).

Forced Calculation

In the course of entering the above forecasts you should have become aware of a problem with the "Monthly Estimates". That, upon entering each formulae, the estimated monthly figure reflects the total for the first four periods divided by twelve instead of the average annual figure (ie 114.83 instead of 392.55 for est.rates).

This, of course, is the notorious order of calculation error which was mentioned early. Here it may be cured by issuing an XECUTE command which recalculates the grid. During planning this error could have been avoided by positioning the monthly estimates column after the December period on the grid.

MIN and MAX

In our final version of the spreadsheet (*Fig 4*) we extract from our table of expenditure the highest and lowest monthly figures and those for a single expenses. These are easily obtained using the functions min and max:

Cell	*Formulae*
?	MAX(C9:N9)
?	MIN(C9:N9)
?	MAX(B4:N7)
?	MIN(B4:N7)

Printing

To print out a spreadsheet simply press [F3+P]. After this you can choose between printing values or formulae. The latter (*Fig 5*) is indispensable for checking the sheet's workings.

Because spreadsheets tend to span more than a single page it is often desirable to print them in a condensed typeface so as to squeeze more rows on to a page. Alternative typefaces can either be set outside the Abacus using Psion's install program or

FIGURE 4

	Monthly Estimate	January actual	February actual	March actual	April forecast	May forecast	June forecast	July forecast	August forecast	September forecast	October forecast	November forecast	December forecast
Rates	£392.55	£320.45	£320.45	£320.45	£416.59	£416.59	£416.59	£416.59	£416.59	£416.59	£416.59	£416.59	£416.59
Gas	£80.19	£129.34	£117.32	£109.87	£98.88	£88.99	£80.10	£72.09	£64.88	£58.39	£52.55	£47.30	£42.57
Electrici	£195.66	£74.54	£109.84	£120.34	£135.38	£152.31	£171.34	£192.76	£216.86	£243.96	£274.46	£308.77	£347.36
Telephone	£203.58	£201.22	£98.97	£134.45	£147.90	£162.68	£178.95	£196.85	£216.53	£238.19	£262.01	£288.21	£317.03
Total	£871.98	£725.55	£646.58	£685.11	£798.75	£820.57	£846.98	£878.28	£914.85	£957.12	£1005.60	£1060.85	£1123.54

Largest monthly Payment	£1123.54
Smallest monthly Payment	£646.58
Largest single Payment	£416.59
Smallest single payment	£42.57

FIGURE 5

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1			F26	F26	F26	F26	F26	F26	F26	F26	F26	F26	F26	F26
2														
3		F11	F11	F11	F11	F11	F11	F11	F11	F11	F11	F11	F11	F11
4		F8				F72	F72	F72	F72	F72	F72	F72	F72	F72
5		F8				F70	F70	F70	F70	F70	F70	F70	F70	F70
6		F8				F69	F69	F69	F69	F69	F69	F69	F69	F69
7		F8				F67	F67	F67	F67	F67	F67	F67	F67	F67
8		F40	F40	F40	F40	F40	F40	F40	F40	F40	F40	F40	F40	F40
9		F12	F12	F12	F12	F12	F12	F12	F12	F12	F12	F12	F12	F12
10		F53	F53	F53	F53	F53	F53	F53	F53	F53	F53	F53	F53	F53
11														
12				F73										
13				F77										
14				F78										
15				F79										

internally by imbedding printer control codes within a cell. Everything printed after that cell will be in the new typeface. All such codes should be preceded by chr(0). For example, for an EPSON FX printer:

Entry	*Result*
chr(0)+chr(14)	Enlarged Mode
chr(0)+chr(15)	Condensed Mode
chr(0)+chr(18)	Pica (normal) mode
chr(0)+chr(27)+chr(69)	Emphasised on
chr(0)+chr(27)+chr(70)	Emphasised off
chr(0)+chr(27)+chr(71)	Double strike on
chr(0)+chr(27)+chr(72)	Double strike off

If codes are to be imbedded then the spreadsheet should be printed without a boundary surrounding it (*Fig 4*). Furthermore if an alternative typeface is used remember to alter the spreadsheets design to accommodate the extra characters. For example, if condensed is selected then press [F3+D+P] and alter the width from its default of 80 to 160.

Complex Functions

Abacus provides a number of advanced functions to cater for specialised circumstances. The simplified Personal Tax calculation in *Fig 6* illustrates a few of these. If you followed the previous example the spreadsheet should be easy to piece together.

First, enter all headings and labels. Formulas F3, F7, F14, F24, F25, F30 and F34 are used to provide the underlining and generally improve the grid's readability. Text should be centre justified and the width in column A altered to fit the longest description (ie "unearned income surplus"). Disregard any text that appears in cells D14 and E15.

Moving on, we can now enter the formulae which underpin the calculations carried out on the grid. The first of these is F35 which slots into B3 and takes the form:

askn("Gross Income")

ASKN is a function which prompts whoever is using Abacus to enter a value into a cell. It comes into effect as soon as it's typed in and whenever an Xecute command [F3+X] is issued. ASKN will only accept numeric input. If you want text entered then use ASKT.

Using ASKN and ASKT it is possible to build up intricate spreadsheets and yet expect somebody unacquainted with Abacus to be able to use them (*Fig 7*). (Provided, of course, that they have been told to press [F3+X].)

The F20 and F21 are similar ASKN constructions. F19 may

```
F8   :ave(C[+1]R[+0]:C[+12]R[+0])
F11  :rept("=",width())
F12  :sum(C[+0]R[-5]:C[+0]R[-2])
F26  :month(col()-2)
F40  :rept("-",width())
F53  :rept("=",width())
F67  :C[-1]R[+0]*1.1
F69  :C[-1]R[+0]*1.125
F70  :C[-1]R[+0]*0.9
F72  :$E4*1.3
F73  :max(C[-1]R[-3]:C[+10]R[-3])
F77  :min(C[-1]R[-4]:C[+10]R[-4])
F78  :max(C[-2]R[-10]:C[+10]R[-7])
F79  :min(C[-2]R[-11]:C[+10]R[-8])
```

FIGURE 6

	A	B	C	D	E
1	Personal Tax Calculation		Tax Rate	Salary	
2	==========		==========	==========	
3	Gross Salary	23000.00	0.00%	0.00	
4	Schedule D	7568.00	30.00%	3000.00	
5	Unearned Income	5678.00	40.00%	11750.00	
6		----------	50.00%	14300.00	
7	Gross Income	36246.00	55.00%	17200.00	
8	Less:Allowances	3000.00	60.00%	21000.00	
9		----------	65.00%	25000.00	
10	Taxable Income	33246.00	70.00%	35000.00	
11		==========			
12					
13	Tax	21609.90	Conclusion:	You need an accountant	
14	Unearned Income Surplus	101.70			
15	Less:PAYE paid	13800.00			
16		----------			
17	Tax Payable	7911.60			
18		==========			

appear strange, however, this is nothing more than:

sum(col) . . . FROM
3 TO 5

When formulae are printed they are expressed in relation to the cell in which they have been entered. Here what the formula **sum(C[+0]R[−4]:C[+0]R[−2])** says is 'Start adding up from the cell that lies zero columns to the right and four rows up from here up to and including the cell zero columns to the right and two rows up'. In other words sum the contents of cells over the range B3 (ie 7−4) to B5 (7−2). Note that negative values indicate columns to the left or rows above the formula cell. Whilst Positive values indicate columns to the right and rows below the formula cell.

If you understand this notation, you should then have no trouble in entering the remaining formulae F12, F33, F37, F38, F40 and F41. If not, then the following may prove useful:

	Cell	*Entry*
(F12)	B10	**B7−B8**
(F41)	B17	**B13+B14−B15**
(F40)	B14	**if((B5>5000), B5*15/100,0)**
(F37)	D13	**if((B13>(B10/2), "You need an accountant", "Pay up")**
(F38)	B13	**B10*lookup(D3: D10,−1,B10)**
(F33)	B15	**B3*lookup(D3: D10,−1,B3)**

The IF Function

The first pair of formulae (F12 & F41) require no explanation. The second pair (F40 & F37) illustrate the use of the conditional expression. This takes the form

IF (conditional_expression, true, false)

A conditional expression is a test whose result can either be true or false. Here, if true, whatever comes after the first comma will be placed in the formula cell. If it is false whatever comes after the second comma will go in. In formula F37 our test is whether a person's tax exceeds half his income. If it does then the words "You need an accountant" will appear in cell D13. If not then the message "pay up" will appear.

With formula F40 we check to see whether unearned income exceeds £5000. If it does then the person will be liable to pay an extra 15% tax on any income above £5000.

Lookup Tables

The last two formulae demonstrate the use of LOOKUP. This takes the form:

lookup(range,offset,value)

and combines a variety of operations into a single function. When passed a value which in F33 is the individual's salaried income (B3) and in F33 is his total taxable income (B10) it:

1. Searches through a designated ordered row or column for the cell whose contents comes closest to but does not exceed the value passed across. In F33 and F38 our ordered row is the "Income level" table column D defined over the range D3:D10. You should note that the table is arranged in ascending order. This is a pre-requisite if the function is to work. If you have not ordered a column or row you may do so using the command Order [F3+O] though it is a good idea to isolate those rows or columns that are linked to each other (ie B & C) from those that are not (ie A). This is because the command when issued re-orders EVERY parallel column or row on the grid.
2. Once the appropriate "income level" has been ascertained D6 and D8 for F33 and F38 respectively, lookup moves one column to the left (ie *offset*=−1 columns in both cases) to the TAX rates column and extracts the corresponding Tax rate applicable to the level of income ie 50% from cell C6 for F33 and 60% from cell C8 for F38.
3. This level of tax is then returned by our function lookup and is used to calculate "PAYE paid" figure in cell B15 and "Tax" due in cell B13.

Scope for Improvement

Whilst the Personal Tax Calculator concludes our analysis of Abacus it is by no means the end of the story. Abacus is an extremely flexible and powerful tool. The Calculator itself could be improved upon. For example, by varying personal allowances in response to the user's circumstances and so on. And beyond this there are dedicated functions such as Net Present Value and Internal Rate of Return tailor made for investment analysis. However, the great attraction of Abacus is that provided the user has grasped a few simple procedures and concepts, everything else comes easy. And it is these procedures and concepts that have been documented here.

FIGURE 7

```
 |          A          |      B      |      C      |      D
1|
2|F7                                  F3            F3
3|                     F35
4|                     F20
5|                     F21
6|                     F14
7|                     F19
8|
9|                     F25
10|                    F12
11|                    F24
12|
13|                    F38                         F37
14|                    F40
15|                    F33
16|                    F30
17|                    F41
18|                    F34
F3   :rept("=",width())
F7   :rept("=",len(C[+0]R[-1]))
F12  :C[+0]R[-3]-C[+0]R[-2]
F14  :rept("-",width())
F19  :sum(C[+0]R[-4]:C[+0]R[-2])
F20  :askn("Schedule D income")
F21  :askn("Unearned income")
F24  :rept("=",width())
F25  :rept("-",width())
F30  :rept("-",width())
F33  :C[+0]R[-12]*lookup(C[+2]R[-12]:C[+2]R[-5],-1,C[+0]R[-12])
F34  :rept("=",width())
F35  :askn("Gross salary")
F37  :if((C[-2]R[+0]>(C[-2]R[-3]/2)),"You need an accountant","Pay
F38  :C[+0]R[-3]*lookup(C[+2]R[-10]:C[+2]R[-3],-1,C[+0]R[-3])
F40  :if((C[+0]R[-9])>5000,(C[+0]R[-9]-5000)*15/100,0)
F41  :C[+0]R[-4]+C[+0]R[-3]-C[+0]R[-2]
```

Quick Reference Table

Function Keys

F1	Load and display help file
F2	Remove/Recover prompts window
F3	Commands
F4	Move cursor between split window
F5	Go to cell

Commands

[A]mend — Amend contents of a cell using input line editor
[C]opy — Copy a range of cells from one area to another
[D]esign — [A]utocalculate – recalculate grid with every entry
[B]lank – substitutes blank cells for zeros
[C]alculation – calculate by row or column first?
[D]isplay – TV or monitor? 40,64 or 80 column
[F]orm Feed – new page after specified no lines
[G]aps – gaps between lines on print out
[L]ines – no of lines per printed page
[M]onetary sign – set for £. Can be varied to accommodate any character
[P]rinter Width – characters per line to print out
[E]cho — Copy contents of a single cell to a range of cells
[F]iles — [B]ackup – make a backup copy of file
[D]elete – delete file
[E]xport – export to [A]rchive,[E]asel or Quill
[F]ormat – format disk or cartridge
[I]mport – import a file
[G]rid — [D]elete – by rows, [c]olumns or range of cells
[I]nsert – by rows or [c]olumns
[W]idth – change width of one or more columns
[J]ustify — Position text or values [l]eft,[r]ight or [c]entre
[L]oad — Load a spreadsheet from microdrive or disk
[M]erge — Merge another spreadsheet. Contents similar cells added or [s]ubtracted from current grid
[O]rder — Sort the rows in a grid into ascending order based upon the contents of one particular column. Applies to text and values but will mess up formulae.
[P]rint — Print out range of cells giving values or formulae
[Q]uit — Terminate Abacus and return to SuperBasic
[R]ubout — Delete contents of cell or range of cells
[S]ave — Save current spreadsheet to disk or drive
[U]nits — [C]ells – change the format of existing cells
[D]efault – change format for cells yet to be used
Formats are:
[D]ecimal – specify no of places
[E]xponent – ie 99.99E+99
[P]er cent – ie 99.99%
[I]nteger – whole numbers
[G]eneral – Automatically selects format to make best possible use of available cell space
[W]indow — [V]ertical – split grid vertically into two windows
[H]orizontal split
[T]ogether – split windows to scroll as one
[S]eparately – Hold one window fixed while other scrolls
[J]oin windows together
[X]ecute — Recalculate all formulae on grid (see [D]esign)
[Z]ap — Clear the grid

Standard Mathematical Functions

ABS(*n*) — Absolute value of *n*
ATN (*n*) — Angle whose tangent is *n* (radians throughout)
COS(*n*) — Cosine of angle *n* in radians
DEG(*n*) — Converts *n* radians into degrees
EXP(*n*) — *e* (approx 2.718) raised to the power of *n*
INT(*n*) — Rounds *n* down to the nearest whole number
LN(*n*) — Natural (base *e*) logarithm of *n* ie LOGe *N*
PI() — Supplies the value of the constant *pi*
RAD(*n*) — Converts *n* degrees into radians
SGN(*n*) — Returns +1,−1 or zero if *n* is >1,<1 or 0
SIN(*n*) — Sine of angle *n* (in radians)
SQR(*n*) — Square root of *n*
TAN(*n*) — Tangent of angle *n* (in radians)

General Functions

CHR(*n*) — ASCII character whose code is *n*
CODE("*text*") — Code for 1st character string
DATE(*n*) — Date as a string whose format varies where: *n*=0 –> *yyyy/mm/dd*; *n*=1 –> *dd/mm/yyyy*; *n*=3 –> *mm/dd/yy*
DAYS("*yyyy/mm/dd*") — Number of days from 1st Jan 1583
INSTR("*main*","*sub*") — Position of the first occurrence of the *sub*string in the *main* string. If not found returns 0
LEN("*text*") — Length of string in characters
MONTH(*n*) — Month as a string ie Jan, Feb etc
REPT("*text*",*n*) — Replicates the 1st character *n* times
STR(*n,type,dp*) — Converts number *n* into a string: *type*=0 –> decimal format; *type*=1 –> exponential; *type*=2 –> integer; *type*=3 –> general; *dp*= no of decimal points
TIME() — Current time as a string –> *hh:mm:ss*
VAL("*text*) — Attempts to coerce string into a number

Grid Functions

AVE(*range*) — Average of values with range of cells
COL() — Cursor's current column position
COUNT(*range*) — Counts number of occupied cells
INDEX(*col,row*) — Extract contents from specified cell
LOOKUP(*range,offset,n*) — Relates a portion of a row (or column) whose values are arranged in ascending order to a second parallel row (or column). Locates the cell in first row whose value is closest to but does not exceed *n*. It then returns the contents of the cell which lines up with this in the second row. The offset is the distance that separates the two rows.
MAX(*range*) — Largest numeric value within range
MIN(*range*) — Smallest numeric value within range
ROW() — Cursor's current row position
SUM(*range*) — Sum of values across range of cells
WIDTH() — Gives width of current column

Programmable Functions

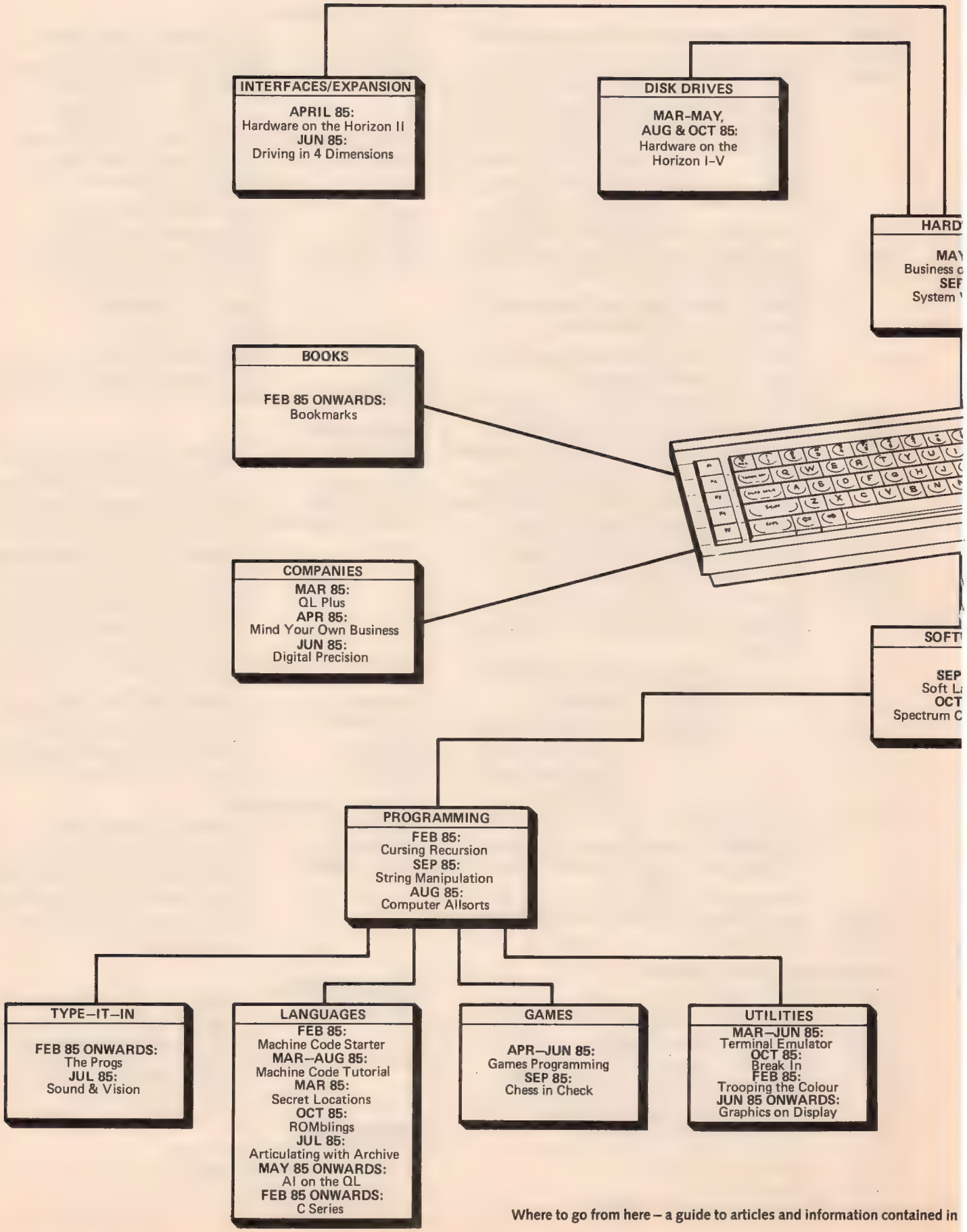
ASKN("*text*") — Prompt for a numeric entry
ASKT("*text*") — Prompt for a text or numeric entry
IF(*expr,true,false*) — Conditional *expr*ession is evaluated and depending on the result a 'true' or 'false' expression is evaluated and a value returned. Arguments may be cell references, strings or numeric expressions.

Financial Functions

IRR(*range,period*) — Calculate the Internal Rate of Return over a range of values where the unit interval or *period* is one month
NPV(*range,%'ge,period*) — Calculates Net Present Value over a range of values where *%'ge* is the annual interest rate.

Line Editing Keys

← Move on characters to the left
→ Move one character to the right
↑ Move to the beginning of line
↓ Move to the end of line



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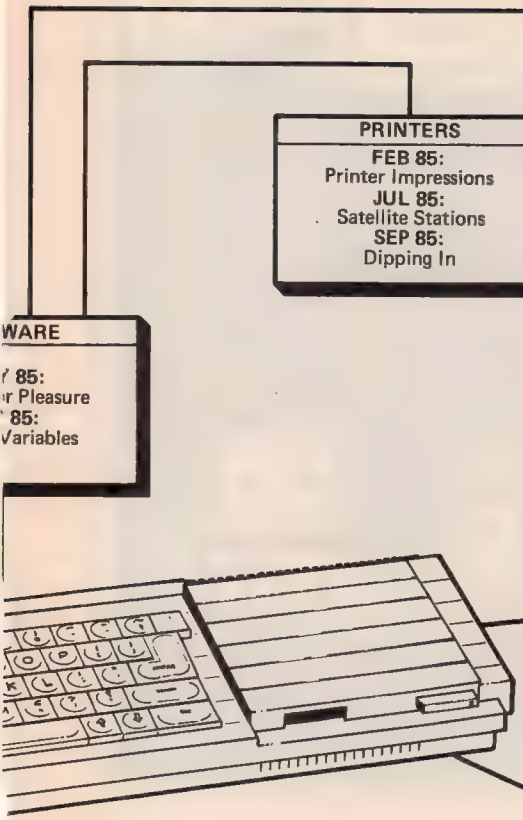

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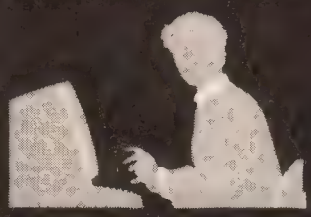

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BASIC SUPERBASIC

The Language

The belief that programs are written entirely from scratch is misplaced. Most programs are an amalgam of pre-written generalised routines stitched together with some original code to serve a particular function or application. Access to a 'library' of such routines saves the programmer from having to literally re-invent the wheel everytime he embarks upon a new project and significantly reduce the time it takes to produce a fully tested working program.

Traditionally the various dialects of BASIC found on micros, with their heavy reliance upon line numbers to control the flow, has meant that self-contained library routines are difficult to put together and even more difficult to incorporate into a program. This explains why program generators, often cumbersome and inflexible, have found favour amongst software developers using this language.

The structured nature of SuperBasic changes all this. DEFineable PROCedures which are called by name (as opposed to line number), allow data to be passed across to them as parameters and yet are capable of processing it in isolation using variables declared LOCal to the procedure. It is these procedures that will go to make up our library.

Creating Procedures

A procedure is defined as follows:

```
DEFine PROCedure name
   (parameter list)
LOCal variable list
.....
RETurn
.....
END DEFine
```

The keywords DEFine PROCedure, LOCal and END DEFine may be abbreviated to DEF PROC, LOC and END DEF. DEF PROC marks the start of the procedure and is followed by the procedure *name*. When used at the start of any statement within a program, this name triggers off the procedure's execution.

The procedure *name* must be unique and should not correspond to a SuperBasic keyword. It must begin with a letter but thereafter it may contain any combination of letters, numbers and underscores ([SHIFT+hyphen]). Spaces and symbols should be scrupulously avoided.

The *parameter list* is made up of variables separated by commas. These may be string, numeric or integer, are used to store data explicitly passed to the procedure and exist only whilst the procedure is being executed. Data is explicitly passed to a procedure by following the call (a statement containing the procedure name) with a list of numbers, strings and variables not enclosed in brackets. This is known as the *argument list*. It must hold the same number of elements as the parameter list and the sequence in which the different data types appear must be identical.

Parameter list variables exist only whilst a procedure executes and are unaffected by and have no effect upon similarly named variables created outside the procedure. However, where the procedure calls itself either directly or indirectly via another procedure, parameter list variables may change.

LOCal is used to declare any variables used exclusively by the procedure. Any values or strings assigned to them must be assigned within the body of the procedure. More importantly, however, not only do LOCal variables exist in complete isolation from outside but also from within. They are 'call-specific' so that if the procedure calls itself then a new set of LOCal variables come into being to act for that call and will exist in isolation from the calling procedures' set of LOCal variables. When a procedure terminates (ie, upon encountering RETURN or END DEFINE) the set of local variables particular to the call that triggered off the procedure's execution will cease to exist.

Obviously if a routine is to be self-contained only LOCal or parameter list variables should be used. This, for a variety of reasons, is often not possible. So where a procedure makes use of an external variable, accesses an element in an array or incorporates a procedure call of its own, this should be documented at the start of the procedure using REM statements so that the person using the library knows exactly what to supply.

The END DEF statement marks the end of the procedure. When encountered it causes the procedure to stop executing and returns control to the statement immediately succeeding the procedure call. A RETurn statement also causes the procedure to terminate but unlike END DEF can occur anywhere within the procedure (Note. The parameter list, LOC and RETurn are all optional and may be omitted).

An example of a simple procedure would be:

```
100 DEF PROC prompt
110 CLS: PRINT "Hello"
120 END DEF prompt
```

If you now call the procedure by entering

prompt[ENTER]

The screen or rather the portion of the screen occupied by the QL's default window (channel #1) will clear and the word "Hello" will display. If you type LIST you will see that the procedure continues to be stored in memory and may be EDITed. A more complex version of the procedure is shown in *Listing 1*.

The revised version of our procedure when called is

LISTING 1

```
100 prompt "Hi-there",0,5,80
110 prompt " This is the QL",1,20,40
120 a$= " an example of a procedure"
130 channel%=2
140 vertical%=20
150 horizontal%=40
160 prompt a$,channel%,vertical%,horizontal%
170 STOP
180 DEFine PROCedure prompt(prompt$,chan%,vert%,ho
riz%)
190 LOCal x_pos%,y_pos%
200 CLS #chan%
210 x_pos%=(horiz%-LEN(prompt$))/2
220 y_pos%=vert%/2
230 AT #chan%,y_pos%,x_pos%
240 PRINT #chan%,prompt$
250 END DEFine prompt
```

passed a string, channel number and the dimensions of the window linked to the channel. Armed with this information the procedure will clear any screen and then display the prompt at its centre. Lines 100 to 170 demonstrates how the procedure may be used.

Note that whilst procedures are called by name, we still have to preceed each line with a line number otherwise the QL's SuperBasic interpreter will not acknowledge its presence within a program. Every line number must be unique and unless the flow of control within a program has been explicitly redirected elsewhere (ie, using a procedure call) then lines will be executed in ascending order until a STOP is encountered.

Tooling up

If the *prompt* procedure is to constitute the first routine in our library we need to work out a way in which it may be filed away and then inserted into any program along with other routines. For this we need to come to grips with the commands RENUM, SAVE and MERGE.

The RENUM command takes the form:

RENUM start TO finish; first, interval

Here you may to specify the *start* and *finish* of the portion of the program to be renumbered, the *first* line from which you wish to count off from and the *interval* between one line number and the next. The QL will not allow RENUM to be used to transfer portions of code from one area of a program to another. Whilst the actual line numbers may be changed their position relative to others in the program listing must remain the same.

If *start, finish, first* and *interval* are omitted the QL will assume their values to be:

start –> [start of program]
finish –> [end of program]
first = 100
interval = 10

The SAVE command takes the form:

SAVE device – filename, start TO finish

Rules governing the naming of files are similar to those for procedures and whilst they may be of any length the QL will only distinguish the first 8 characters. Common device names are *'mdv'* for microdrives, *'flp'* or *'fdk'* for disks and *'ram'* for extra memory. Default values for *start* and *finish* are identical to those that apply to RENUM.

The MERGE command takes the form:

MERGE device_filename

and allows programs or routines to be joined together. Where duplicate line numbers occur, those within the program being merged will overwrite those in the program currently loaded in memory.

Modus Operandi

The convention we will adopt for our library is to RENUMber each procedure, once it has been fully tested, from line 30000 onwards and then save it to a microdrive cartridge or disk using the procedure name as a file name. In this way, when it comes to incorporating a library routine into a program we need only merge it and then RENUM so that the routine is shuffled down leaving room for another to be merged in, and so on. This method will work in almost every circumstance excepting where programs are longer than 29999 lines or the routines exceed 2767 lines – both of which are very unlikely.

We can now install our first routine on the library cartridge. First, enter RENUM 180;30000 so that the procedure *prompt* looks something like *Listing 2*. Now save the routine to your library cartridge using:

SAVE mdv1_prompt,30000 to 30080

LISTING 2

```
30000 REMark *** prompt ***
30010 DEFine PROCedure prompt(prompt$,chan%,vert%,
horiz%)
30020 LOCal x_pos%,y_pos%
30030 CLS #chan%
30040 x_pos%=(horiz%-LEN(prompt$))/2
30050 y_pos%=vert%/2
30060 AT #chan%,y_pos%,x_pos%
30070 PRINT #chan%,prompt$
30080 END DEFine prompt
```

General input

Most programs require some information of the persons using them. As only the few QLs running version JS of QDOS have any built-in error trapping, information typed in at the QL's keyboard is usually stored in a string variable using the INPUT command. The general input routine in *Listing 3* should satisfy most requirements.

Dealing first with the parameters. The string *i$* is used to pass across and display any previously entered input ready for amendment. If the operator does not enter anything the previous input will be carried forward to be stored in the variable *temp$* (more on this later). If there has been no previous input then a row of underscores will display, equivalent in length to the maximum size of the string expected which is passed across by *s*. The remaining parameters are simply (*c*)hannel number and *x* and *y* co-ordinates of the input line.

The next point of interest is in the use of the variable *temp$*. This is used to store the actual input. It is an external variable and so may be accessed outside the program. As we use *temp$* thoughout our library to pass information out of a procedure it is advisable that the contents of *temp$* are stored somewhere safe immediately after the procedure has executed.

Another point to note is that the input routine makes use of the procedure *prompt* which we developed earlier and will not work unless it is also incorporated into a program. Any procedure may call another and even call itself.

(Continued on p.15)

LISTING 3

```
30000 REMark *** gen_in ***
30010 REMark Procedure calls: prompt
30020 REMark External variables: temp$ =returns in
put  program
30030 DEFine PROCedure gen_in(i$,s,c,x,y)
30040 REPeat g_entry
30050   temp$=i$
30060   IF i$="" THEN temp$=FILL$("_",s)
30070   AT #c,y,x:CLS #c,4:PRINT #c,temp$
30080   AT #c,y,x:INPUT #c,temp$
30090   IF temp$="" THEN temp$=i$
30100   IF LEN(temp$)<s+1 THEN EXIT g_entry
30110   prompt "Too long try again",1,20,80
30120 END REPeat g_entry
30130 AT #c,y,x:CLS #c,4:PRINT #c,temp$
30140 END DEFine gen_in
```

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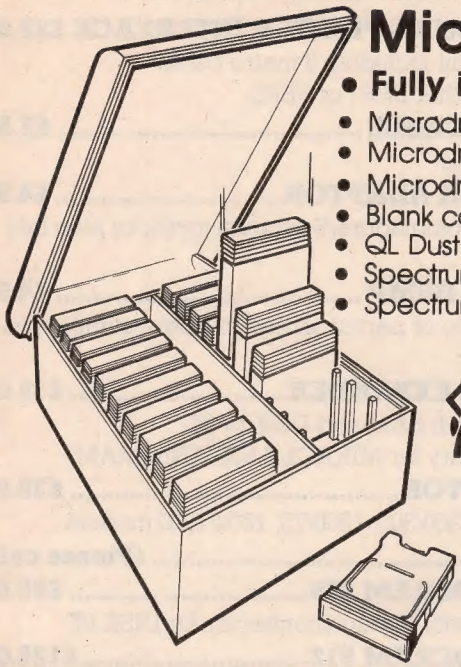

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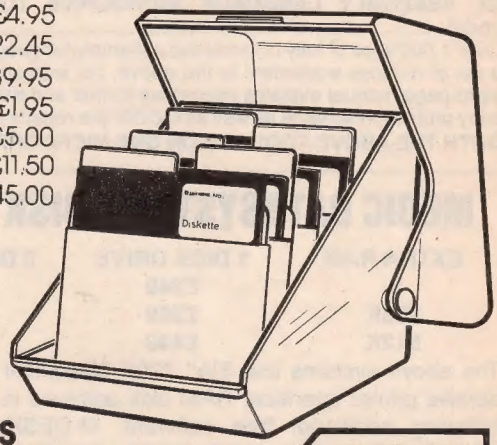

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The SuperBasic INPUT command will only work provided a channel has been OPENed to the console device (ie, the keyboard). Channel 0 is opened this way by default. Other channels require the command:

OPEN #channel_no,con_

The short program in *Listing 4* will demonstrate *gen_in* in action provided, of course, that you have remembered to RENUMber and MERGE in *prompt* from the library.

Quite simply the program asks for a name of up to 15 characters in length and compares it with the string "RUMPELSTILTSKIN". If no match occurs it redisplays the previous entry for amendment. The == operator means that the comparison will not fail if the wrong case is used (ie, it will accept normal letters as well as capitals).

Your menu

Our next library routine (*Listing 5*) amply demonstrates the power of procedures. It permits us to set up menus anywhere within a program with a simple call.

The routine requires that a three dimensional string array called option$ is set up prior to the procedure call (ie, DIM option$(*x,y,z*)). The size of the array will depend on the number of different menus required (*x*), the number of lines that will fit the particular window in which the menu will display (*y*) and the number of letters which will print to the line (*z*). The program's only external variable *temp* returns the menu option selected by the user as the numeric value that corresponds to that option *y* subscript within the array *option$*.

The parameters for the procedure are relatively straightforward. *C* is the channel number linked to which menu window is chosen. *menu_no* holds the *x* subscript value and determines which menu will display. *Options* will determine how many options the user will be able to choose from. Clearly neither *menu_no* nor *options* may exceed the array size.

The procedure also demonstrates one way of detecting whether a key has been pressed. This is achieved by imbedding the command INKEY(−1), which causes the QL to wait until a key has been pressed, within a repeat loop. When a key has been pressed INKEY returns the character code for the particular key pressed. By comparing this against the code for a desired key we can determine whether to repeat the instruction or exit from the loop.

In *menu*'s case we only exit if the code returned matches the code for the [ENTER] key. However, if the UP or DOWN keys are pressed then the value of *loop* is decreased or increased respectively. *Loop* determines which option is highlighted and its value parallels the particular option's *x* subscript value. In effect *loop*'s keeping track of two different things simultaneously, this saves on memory and makes for greater efficiency, it does, however, mean that the code is a little harder to read.

It's also worth noting that *loop* is, as it were, a 'second hand' variable first used in the FOR loop in line 30060. As it saves memory it is a good idea to re-use old variable or arrays when they are no longer needed.

Menu may be tested using the program in *Listing 6*.

The FOR loop here is used to place a string in each of the ten options in the first menu of the array. The options themselves merely contain the repetition of the option number generated using the FILL$ command. This is purely arbitrary. If the array was to hold meaningful data we would probably use the READ command to extract information stored on DATA lines within the body of the program. If this is the case it is always good practice to tell the computer where the first line containing the DATA is located using the

LISTING 4

```
5 REMark QL Fairytale
10 OPEN #2,con_
20 CLS:PAPER #2,0
25 prompt "What is my name ?",0,5,80
30 gen_in "",15,2,2,2
40 REPeat loop
50   IF temp$=="RUMPELSTILTSKIN" THEN EXIT loop
60   gen_in temp$,15,2,2,2
70 END REPeat loop
75 prompt "correct !!!",0,5,80
80 STOP
100 REMark *** gen_in ***
```

LISTING 5

```
30000 REMark ********* menu **************
30010 REMark calls: none
30020 REMark external variables: option$(),men_sel
30030 DEFine PROCedure menu (c,menu_no,options)
30040 LOCal loop,key
30050 CLS #c:INK #c,0:STRIP #c,7
30060 FOR loop= options TO 1 STEP -1
30070   IF loop=1:INK #c,7:STRIP #c,0:END IF
30080   AT #c,loop,3:PRINT #c,option$(menu_no,loop
)
30090 END FOR loop
30100 REPeat men_sel
30110   key =CODE(INKEY$(-1))
30120   IF key=216 OR key=208
30130     STRIP #c,7:INK#c,0:AT #c,loop,3:PRINT #c
,option$(menu_no,loop)
30140     IF key=208 THEN loop=loop-1
30150     IF key=216 THEN loop=loop+1
30160     IF loop<1 THEN loop=options
30170     IF loop>options THEN loop=1
30180     STRIP #c,0:INK #c,7:AT #c,loop,3:PRINT #
c,option$(menu_no,loop)
30190   END IF
30200   IF key=10 THEN EXIT men_sel
30210 END REPeat men_sel
30220 temp=loop:PAPER #c,7:INK#c,0
30230 END DEFine menu
```

LISTING 6

```
100 OPEN #1,scr_
110 DIM option$(10,10,20)
120 FOR l=1 TO 10
130 option$(1,l)=FILL$(l,20)
140 END FOR l
150 menu 1,1,10
160 PRINT #0,"option"!temp!"chosen"
170 STOP
```

LISTING 7

```
100 OPEN #1,scr_
110 DIM option$(5,5,20)
120 RESTORE 2000
130 FOR outer_loop=1 TO 5
140   FOR inner_loop=1 TO 5
150     READ option$(outer_loop,inner_loop)
160   END FOR inner_loop
170 END FOR outer_loop
180 menu 1,1,5
190 REPeat forever
200   menu 1,temp,5
210 END REPeat forever
220 STOP
2000 DATA "Monday", "Tuesday","Wednesday","Thursda
y","Friday"
2010 DATA "bananas","oranges","melons","lemons","b
ells"
2020 DATA "Parsnip","carrot","lettuce","onion","ga
rlic"
2030 DATA "SuperBasic","Pascal","FORTRAN","C","BCP
L"
2040 DATA "RAM","ROM","CPU","ALU","IPA"
```

RESTORE line_no command. The method is illustrated in *Listing 7*.

The program here will go on forever as the REPeat loop has no EXIT. Also of interest is the nested FOR loop construction which enables each menus' option to be READ in a consistent and easily understood fashion. For every pass through the *outer_loop*, the *inner_loop* goes round five times.

Introducing files

If menu options are to be changed frequently then the best way of storing the information is not on a DATA line but in a data file on microdrive or disk. We can rewrite our previous example to deal with the file *options* stored on microdrive 1 as in *Listing 8*.

All that we have to do here is OPEN a channel (for input – line 120) to the file and then read information in from it using the INPUT command linked to that channel (line 150). When we've finished we close down the channel. This, program however, is useless without one which will enable us to create and amend the menu *options* file. This is given in *Listing 9* along with a short explanation of what it does. (In part III we will examine the various techniques introduced here in greater detail).

The program asks if menu options are to be amended or created. If they are to be amended it will open a channel to an existing file called *options* (on mdv1) and read in the data from it using the INPUT command. At the same time it opens a separate channel to an entirely new file called *new options*. As the information is read in the user has the opportunity to amend it using the *gen_in* library procedure.

Whether amended or unamended this information is read into our *option$* array and then saved to new options. When all five options on all five menus have been dealt with we close *new_options* and then *options*. We then delete the now out of date original *options* file and create a new one by simply copying across *new_options*. Once we have done this we delete *new_options* in readiness for the next time amendments have to be made.

If new options are to be created from scratch, the process is the same except that we dispense with the options file altogether – it is never opened, read closed or deleted.

LISTING 8

```
100 OPEN #1,scr_
110 DIM option$(5,5,20)
120 OPEN_IN #4,mdv1_options
130 FOR outer_loop=1 TO 5
140   FOR inner_loop=1 TO 5
150     INPUT #4,option$(outer_loop,inner_loop)
160   END FOR inner_loop
170 END FOR outer_loop
175 CLOSE #4
180 menu 1,1,5
190 REPeat forever
200   menu 1,temp,5
210 END REPeat forever
220 STOP
```

LISTING 9

```
100 DIM option$(5,5,20)
110 prompt "Create or amend file [C/A]",1,5,40
120 REPeat choice
130   gen_in "",1,0,2,2
140   IF temp$=="C" OR temp$=="A" THEN EXIT choice
160 END REPeat choice
170 IF temp$="A" THEN process 1:ELSE process 0
180 STOP
185 REMark ***** process *****
190 DEFine PROCedure process(flag)
195 LOCal k,kk
200 OPEN_NEW #5,new_options
210 IF flag THEN  OPEN_IN #4,mdv1_options
220   FOR k=1 TO 5
230     FOR kk=1 TO 5
240       prompt "Menu "&k& " option "&kk,1,20,80
250       IF flag THEN INPUT #4,option$(k,kk)
260       gen_in option$(k,kk),20,0,20,40
270       option$(k,kk)=temp$
280     END FOR kk
290   END FOR k
300 IF flag
310     CLOSE #4
320     DELETE mdv1_options
330 END IF
340 COPY mdv1_new_options TO mdv1_options
350 DELETE mdv1_options
360 END DEFine process
```

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